

THE JAMESTOWN PROJECT



JAMESTOWN, VIRGINIA



National Park Service
Colonial National Historical Park, Jamestown Unit

Association for the Preservation of Virginia Antiquities
Jamestown National Historic Site

Volume 1
Chapters 1-3

THE JAMESTOWN PROJECT

FINAL DEVELOPMENT CONCEPT PLAN & ENVIRONMENTAL IMPACT STATEMENT

Location: Jamestown National Historic Site
Colonial National Historical Park, Jamestown Unit
Jamestown, Virginia

Responsible Agencies: National Park Service, United States Department of the Interior
Association for the Preservation of Virginia Antiquities

Proposed Action: Jamestown, the birthplace of modern American society, is a world-class cultural and historic treasure that needs to be promoted, explored, and fully presented to communicate its significance in history. Often overlooked, Historic Jamestowne - America's Birthplace is the site of the first permanent English colony in North America, predating Plymouth, Massachusetts, by more than a decade. It marks the time and place of the beginning of the history of this nation.

Based on Jamestown's importance to United States history and its numerous opportunities for research and discovery, the overriding purpose of the Jamestown Project is for the APVA and NPS to jointly **research, protect, and present** to the public the resources at Jamestown. The APVA and NPS would like to capitalize on their strong partnership and recent discoveries to enhance educational and research opportunities and connect the visitor more closely with the site, its past peoples, and their experiences. In order to reach and educate the broadest possible audience, the Jamestown Project goals are to: improve the quality of the visitor experience; protect the Jamestown collection and associated archival materials; enhance research and educational opportunities; and strengthen the APVA/NPS partnership.

Five alternative plans for the Jamestown Project are presented in this DCP/EIS, including a No Action Alternative that would continue current conditions and four action alternatives. The proposed alternatives have been designed to protect cultural and natural resources while furthering the goals of the project. The proposed plans involve strategies for an updated interpretive experience; the improvement of facilities (including the current Visitor Center, collections storage, and parking); the addition of comfort/hospitality services and new interpretive venues; and enhanced and multimodal transportation options (including water taxis/tours, hike/bike trails, and shuttle services). This document assesses both the adverse and beneficial impacts of the alternatives on partnerships; cultural, physical, natural, and socioeconomic resources; research and education; visitor experience; operations; and transportation and site access.

Note to Reviewers and Respondents The Final Development Concept Plan/Environmental Impact Statement has been prepared based on the comments received during the 60-day public review of the draft document. Every comment was considered carefully by the planning team. Letters received from federal, state, and local agencies and organizations as well as formal responses to substantive comments are included in "Chapter 5: Consultation and Coordination." Should you have further concerns or comments on the Jamestown Project, please contact Alec Gould, Park Superintendent, as listed below.

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Founded in 1889, The Association for the Preservation of Virginia Antiquities (APVA) is the oldest statewide preservation organization in the nation. Today, thanks to the continuing support of members and generous donors, the APVA is sharing the rich heritage of Virginia through a portfolio of properties that span the centuries from early seventeenth through the mid-nineteenth centuries. The APVA's Revolving Fund adds a dimension to the organization's ability to preserve Virginia's historic past by partnering with individuals and organizations interested in preserving sites across the state. A nonprofit, charitable, and educational organization, the APVA is preserving, interpreting, and sharing significant landmarks across the Commonwealth of Virginia to benefit visitors today and future generations.



As the nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering sound use of offland and water resources; protecting our fish, wildlife, and biological diversity; preserving the environmental and cultural values of our national parks and historical places; and providing for the enjoyment of life through outdoor recreation. The department assesses our energy and mineral resources and works to ensure that their development is in the best interests of all out people by encouraging stewardship and citizen participation in their care. The department also has a major responsibility for American Indian reservation communities and for people who live in island territories under U.S. administration.

April 2003

United States Department of the Interior- National Park Service



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3

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- 3.2 Partnerships
- 3.3 Resources and Environment
 - 3.3.1 Cultural Resources
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 - 3.3.3 Socioeconomic Resources
- 3.4 Research and Educational Programs
- 3.5 Visitor Experience
- 3.6 Operations
- 3.7 Buildings and Utilities
- 3.8 Transportation and Site Access



3 Affected Environment

3.1 INTRODUCTION

The information presented in this chapter describes the Jamestown Project environment that would be affected by the alternatives and/or that would affect the alternatives if they were implemented. This baseline information is necessary to understand the issues and alternatives and to determine the impacts of the alternatives, as discussed in “Chapter 4: Environmental Consequences.” Relevant impact topics were selected based on agency and public concerns, regulatory and planning requirements, and known resource issues. This chapter also includes references to the applicable laws, regulations, and guidelines that were considered in developing the alternatives. A complete list of relevant statutory, regulatory, and policy requirements pertaining to the Jamestown Project is included in Appendix B (Table B-1).

3.1.1 Impact Topics Fully Analyzed and Chapter Organization

The following impact topics were chosen based on the Council on Environmental Quality’s NEPA regulations (40 CFR 1500-1508) and National Park Service *Director’s Order 12: Conservation Planning, Environmental Impact Analysis, and Decision-making*; by assessing the issues raised during regulatory and public scoping meetings; and by observing the potentially affected resources at and adjacent to the Jamestown Project area. The impact topics are organized throughout this chapter and in “Chapter 4: Environmental Consequences,” as they are listed in Table 3-1. In addition, resources that are located in the Jamestown Project area but would not be

affected by the alternatives are briefly discussed in this chapter and are included in the outline. However, these resources were not analyzed further, and they will not appear in “Chapter 4: Environmental Consequences.”

3.1.2 Impact Topics Considered but Dropped from Further Analysis

Listed below are environmental considerations and related laws and regulations that were identified but dropped from further analysis because they do not apply to the proposed alternatives or the existing conditions at the Jamestown Project area.

Executive Order 12898, “Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations”

Based on the proposed alternatives, there would be no disproportionate direct or indirect adverse effects on any minority or low-income populations. The Association for the Preservation of Virginia Antiquities (APVA) and the National Park Service (NPS) have actively engaged the public during the planning process and considered all input, regardless of age, race, income status, or other socioeconomic or demographic factors.

Mining Activity within National Park Service Areas Act of 1976

The proposed alternatives do not involve any mining activities; thus no natural or depletable resources would be removed from the Jamestown Project area.

Table 3-1: Chapter Outline

Partnerships

APVA and NPS
Jamestown Settlement
Colonial Williamsburg
William & Mary, University of Virginia, and other Educational Partners
Eastern National
Others

Resources and Environment

Cultural Resources

Site History and Significance
Ethnographic Resources
Archaeological Sites
Historic Buildings, Structures, and Cultural Landscapes
Archives and Collections

Physical and Natural Resources

Physiography, Topography, and Climate
Geologic Setting
Soils
Soil Types
Hydric Soils
Prime Farmland Soils
Chesapeake Bay Resources
Surface Waters
Shoreline
Nearshore Environment
Hydrodynamic Setting
Water Quality
Floodplains and Flood Zones
Wetlands
Groundwater
Vegetation
Wildlife
Rare, Threatened, and Endangered Species

Resources and Environment cont.

Visual Quality and Aesthetics (Includes Scenic Roads and Scenic Rivers)
Air Quality
Noise
Hazardous Materials

Socioeconomic Resources

Land Use and Zoning (Includes Public Recreational Facilities and Farmlands and Forest Lands)
Demographics and Income
Regional and Local Economy
Emergency Services

Research and Educational Programs

Visitor Experience

Regional Visitor Experience
Jamestown Visitor Experience
Interpretive Themes
Visitor Orientation
Visitor Understanding of Significance
Carrying Capacity of Programs and Sites
Amenities
Visitor Characteristics
ADA Accessibility

Operations

Buildings and Utilities

Transportation and Site Access

Public Recreational Lands

The proposed alternatives would not impact any designated public recreational lands.

Farms and Farmlands (Except for Prime Farmland Soils)

None of the alternatives would impact either Mainland Farm or Gospel Spreading Farm (see Figure 1-1) because they are located outside the project area.

Indian Trust Resources

Federal agencies are directed to avoid land use conflicts with interests of American Indian¹ tribes and impacts to Indian Trust Resources. The Jamestown Project site is not considered an Indian Trust Resource, and none of the proposed actions would conflict with American Indian interests. Additionally, both NPS and APVA staff have discussed the proposed alternatives with representatives of various American Indian tribes. See “Chapter 5: Consultation and Coordination,” for more information related to these discussions.

Executive Order 13007, “Access and Use of Sacred Sites”

The Jamestown Project area is not considered a sacred site by the Keeper of the National Register of Historic Places nor by any of the tribes historically associated with the Jamestown area. As mentioned above, APVA and NPS staff have discussed the proposed alternatives with American Indian tribe representatives, and these discussions are presented in “Chapter 5: Consultation and Coordination.”

Native American Graves Protection and Repatriation Act (NAGPRA)

Because of Jamestown’s long human history and known association with nearby tribal communities, some minimal potential for

discovery of human remains and associated items of cultural patrimony exists. The Native American Graves Protection and Repatriation Act (NAGPRA) addresses the rights of tribes and the consultation procedures regarding certain human remains and affiliated cultural items. To comply with the provisions of the act and its implementing regulations (43 CFR 10), NPS managers will establish a prompt and effective notification system to consult with concerned groups regarding discovery of human remains and associated objects. Managers will deal with such burials on a case-by-case basis with informed awareness of tribal concerns. Burials and associated objects will be afforded the greatest respect, and the National Park Service and APVA will consult with the tribes regarding remains associated with these groups. A NAGPRA implementation plan will be developed to include strategies for discussing archaeological investigations and inadvertent discoveries with the Virginia Council of Indians and the United Indians of Virginia.

Light Impacts on Wildlife and the Night Sky

Artificial lighting within the Jamestown Project area is limited to the first bay of the Island parking lot. There are three 20-foot-tall, high-pressure sodium light fixtures, which provide a minimum level of illumination for staff during the winter hours. (The lights are controlled by a timer and are on between 5 and 7 p.m.) In addition, the lights are used during special event evenings and are turned off immediately once the last car leaves the Island.

Based on the proposed alternatives, artificial lighting would be required at the Neck of Land parking lot in Alternatives B, C, and E. Light fixtures would be of the same type as in the Island parking lot, and they would only be placed in locations necessary for security and public safety.

¹ Where specific tribes or names are unknown, the collective term “American Indian” will be used, per NPS policy.

Special Events of 2007

At the onset of the Jamestown Project, planning team members agreed that this *Development Concept Plan/Environmental Impact Statement* (DCP/EIS) would not address impacts related to special events of 2007. Two main reasons for this decision include the fact that events have not yet been determined and the Jamestown Project represents alternatives designed for 2007 and beyond.

3.2 PARTNERSHIPS

3.2.1 APVA and NPS

The APVA and NPS have jointly owned and managed Jamestown Island since 1932, formally documenting their partnership with Memoranda of Agreement in 1940, 1956, and 1999. The Jamestown Island partners have found new and innovative ways to work together to benefit both Jamestown's visitors and to preserve its resources. Since its inception, the APVA-NPS Memoranda of Agreement have been expanded to reflect this ever-changing dynamic. Examples of past cooperation include collaborative programming, shared museum collection storage facilities, and cooperation on museum shop services. Since 1995, the APVA and Colonial NHP have sought ways to plan together for the facilities, transportation, and programming for 2007 and beyond. This work began with their cooperation on the *General Management Plan for Colonial NHP* (NPS 1993b) and expanded to master planning for the Jamestown interpretive experience and preparation of this *Development Concept Plan/Environmental Impact Statement*. This private-public partnership has allowed each organization to bring its strengths and unique talents to the planning process and management of Jamestown Island to ensure success.

3.2.2 Jamestown Settlement

Immediately adjacent to Colonial National Historical Park is the Commonwealth of Virginia's Jamestown Settlement, 1607 Living History Museum. The Jamestown-Yorktown Foundation, a state agency, oversees the operations of that museum. Created for the 350th anniversary of the landing at Jamestown, and formerly known as Jamestown Festival Park, the Jamestown Settlement is built on 15 acres, of which the National Park Service donated 10.02 acres to the Commonwealth of Virginia in 1956 (P.L. 84-448, 70 Stat. 61). It features a museum and reconstructions of the fort, Indian village, and three ships used in 1607. The Settlement also has an extensive educational program. The Settlement is significantly expanding its museum facilities and enhancing its re-created area with a new ship's pier area.

The NPS and the APVA have no formal cooperative agreement with the Jamestown-Yorktown Foundation. Through various scheduled meetings during the past year and a half, the Jamestown entities have discussed "One Jamestown" as a concept. This concept recognizes that a complementary and collaborative experience would better meet the needs of visitors to the area. This effort is not meant as a way to meld the organizations; however, efforts toward building a formal partnership with the foundation continue.

The Jamestown-Yorktown Foundation also oversees the state-chartered Jamestown 2007 (originally the Celebration 2007), which seeks to coordinate the participation of state agencies in the 400th anniversary observance.

3.2.3 Colonial Williamsburg Foundation

Since 1992, Colonial NHP and the Colonial Williamsburg Foundation have had a cooperative agreement to conduct archaeological, historical, cultural and scientific research, as well as monitoring

and interpretive activities related to the protection and management of cultural and natural resources of the park. The agreement includes jointly developing automated geographic information systems to support the identification, evaluation, and monitoring of natural and cultural resources. The two organizations also cooperate on the development of educational programs and publications. The cooperative agreement requires the park to provide access to and space in the park and the park's museum collection for documenting and research and also to provide the necessary permits (e.g. collecting, special use, research) required for the work conducted under the agreement.

In addition, the APVA has been a partner with Colonial Williamsburg since the 1930s. Work on specific projects has been facilitated through formal and informal means. Research and analysis for specific projects has been worked through letters of contract with the foundation. Exhibition planning, volunteer programs, and conference planning have been worked through collaborative efforts.

3.2.4 William & Mary, University of Virginia, and Other Educational Partners

The National Park Service and the College of William and Mary have also cooperated for quite some time. Between 1992 and 1999, the college participated in the cooperative agreement between Colonial NHP and the Colonial Williamsburg Foundation that prepared the Jamestown Archeological Assessment. In 1999, the park and the college established a separate cooperative agreement for a general program of research, education, and resource monitoring related to the educational and professional needs of the college and the management and protection of cultural and natural resources of the park. The agreement also encourages the development and teaching of classes related to that research, as well as the publishing of the findings. The cooperative

agreement requires the park to provide access to, and space in, the park and the park's museum collection for documenting and research and to provide the necessary permits (e.g. collecting, special use, research) required for the work conducted under the agreement.

Annually since 1994, the APVA has worked with the University of Virginia to provide students with the opportunity to participate in a field school program. The six-week summer program attracts students from across the nation to Jamestown for an intense period of archaeological study. The students learn archaeological methods, participate in lectures and field trips, and receive graduate credit from the University of Virginia for their participation. In 2001, the field school was expanded when Colonial NHP archaeologists taught students survey techniques on Jamestown's New Towne property. Colonial NHP archaeologists will continue coordinating with APVA archaeologists for future summer field schools, as Colonial NHP is co-sponsoring the 2002 program.

APVA also has sponsored an intern from the University of Virginia's Institute of Public History to help develop educational programs, to assess and analyze visitor satisfaction, and to assist with a traveling exhibition on the Jamestown Rediscovery™ archaeological project.

Interagency and cooperative agreements provide students with educational experiences, the public with valuable information, and the National Park Service with needed research, inventory, and monitoring assistance. They also provide technical advice on the management and protection of park resources. The NPS has longstanding partnerships with the U.S. Fish and Wildlife Service, U.S. Environmental Protection Agency, U.S. Geological Survey and Biological Research Division, Virginia Department of Environmental Quality, Virginia Institute of Marine Science, Virginia Department of Conservation and Recreation Division of Natural Heritage, North Carolina State University, and the

College of William & Mary's Center for Conservation Biology to research, inventory, and monitor the park's natural resources and their conditions.

3.2.5 Eastern National

Both the APVA and the National Park Service are partners with Eastern National, a cooperating association.

Eastern National operates the museum shop in the Visitor Center under an agreement with the APVA, and the Glasshouse demonstration and gift shop under an agreement with the Park Service. The NPS partners extensively with Eastern National at other parks as well, including Yorktown National Battlefield, another unit of Colonial NHP.

3.2.6 Others

In addition, APVA has partnered with researchers at laboratories and institutes in the United States and in Europe to further the archaeological research under its direction.

In 1997, the APVA partnered with the National Geographic Society to provide information and objects for an exhibit focusing on the rediscovery of James Fort. More than 500,000 people visited the exhibit in Washington. The exhibit then traveled to the Virginia Historical Society in Richmond and to Jamestown.

The park, under a cooperative agreement with the Organization of American Historians, established the Jamestown Scholars in 2000 to encourage doctoral research on Jamestown, focusing especially on the 17th century.

Appendix E contains a complete list of partnering organizations.

3.3 RESOURCES AND ENVIRONMENT

The existing cultural, physical, natural, and socioeconomic resources are presented below.

3.3.1 Cultural Resources

National Park Service management policies and *Director's Order 28: Cultural Resource Management* mandate that cultural landscapes, historic buildings, ethnographic, and archaeological resources be addressed as important to the park. As such, documentation and analysis of these resources are an important part of all NPS planning efforts and must be addressed in this DCP/EIS. The evaluation of historical integrity and significance of these resources is done through historical research, field documentation, and evaluation criteria, as described in the *Secretary of the Interior's Standards for the Treatment of Historic Properties* (1996b). Research findings from this process help people make educated management decisions for preservation, interpretation, and maintenance of significant features. This information also becomes valuable in satisfying compliance with Section 106 of the National Historical Preservation Act of 1966, as amended, which requires that federal agencies consider the effects of their proposals on historic properties and consult with the State Historic Preservation Officer and, as necessary, the Advisory Council on Historic Preservation.

In addition, the 1992 amendments to the National Historic Preservation Act and the Archaeological Resources Protection Act provide the means for certain information to be withheld from public disclosure if that disclosure could risk harm to potential and actual resources. That information could involve the character, location, or ownership of archaeological sites, historic properties, and ethnographic sites, including traditional and cultural sites. Throughout this

process protective measures have been taken and will continue to be taken to protect Jamestown's resources.

3.3.1.1 Site History and Significance

The significance of Jamestown goes well beyond its role as the first permanent English settlement in North America. At Jamestown, the merging of peoples from three continents – North America, Europe, and Africa – began to form a distinctly different and unique society, culture, and nation now known as the United States of America. In addition to John Smith, Pocahontas, Sir William Berkeley, and Nathaniel Bacon, the thousands of men, women, and children from these three continents and their varied cultures left their mark at Jamestown in building a new society here. However, Jamestown was not the first English settlement in North America, and certainly not the first European settlement. For more than a century, Spain and Portugal had explored, claimed, and settled the Western Hemisphere; the Dutch and Swedish also had early settlements (Santa Fe, New Mexico and Quebec City, Quebec are contemporaries of Jamestown). Even though Europeans from many countries found their way here, Jamestown was the first successful English colony in the hemisphere.

Although evidence of human presence dates back 10,000 years, the focal period at Jamestown is 1607-99, from the first English settlers to the transfer of the capital from Jamestown to Williamsburg. During those nine decades, the colony developed from an uncertain enterprise to a successful capital. European exploration and settlement quickly dispersed along the major rivers and the Chesapeake Bay.

Jamestown's many legacies remain today in American society, customs, legal structures, and language used nearly 400 years later.

Although named Virginia after Elizabeth I, this was no "virgin land" but one already occupied. The Jamestown colonists chose an island, a place used by many generations of Virginia Indians. They had complex political systems and alliances, and well-

established economic patterns and societies. From the beginning of the colony, the European settlers (not all were English) also tried to ensure economic sustainability for themselves and the colony, beginning with exporting lumber in 1607, expanding into glass-making attempts in 1608, and eventually developing tobacco as the cash crop that resulted in a slave-based economy. While some colonists came as freeholders, many came as indentured servants, selling their labor for passage. In 1619, the first Africans were brought to Virginia. Debates continue over the evolution of slavery, but Virginia clearly shifted from a society with slaves to a slave society during this period.

This nation's representative government can be traced directly to Jamestown's first legislative assembly in July 1619. The impact of Jamestown's judicial and legislative decisions and actions reached from the Atlantic Ocean to the Great Lakes, the area then claimed as Virginia. In the aftermath of Bacon's Rebellion in 1676, which left Jamestown in ruins, the English government began overseeing more carefully its colonies' activities and began restricting some of the rights the emerging independent society had enjoyed. In 1699, the capital moved to nearby Williamsburg. For nearly 90 years, Williamsburg served as the political hub where in the 1770s changing attitudes and fateful decisions shifted Virginians from being loyal British colonists to independent Americans seeking freedom. The eruption of the American Revolution in 1775 and the major 1781 victory at Yorktown, less than 25 miles from Jamestown, ended the British colonial experience.

Jamestown's significance did not end in 1699. Because Jamestown was the birthplace of the United States, the anniversary of its founding has been commemorated since 1807. In 1893, the APVA founded to save Jamestown, began its efforts to preserve the sole remaining 17th century structure, the Church Tower. The women who established the APVA – the first statewide preservation organization in the nation – acquired 22.5 key acres

on the Island and sponsored archaeological research of the church. The 300th anniversary commemoration in 1907 marked the first national recognition of Jamestown with the erection of an obelisk by the federal government. In 1930, Congress established the Colonial National Monument, and a presidential proclamation declared a commitment to commemorating and preserving the area traditionally known as “the historic triangle” – Jamestown, Williamsburg, and Yorktown – by purchasing and preserving the remaining 1,500 acres of Jamestown Island and the Yorktown Battlefield, and connecting them with a road, the Colonial Parkway.

In the 1930s extensive archaeology began at Jamestown. J.C. Harrington, who oversaw much of this work, is credited with establishing the basic tenets of historical archaeology still used today. The Civilian Conservation Corps (CCC) camp here – one of the few African-American CCC camps – excavated the original 17th century structures. In the 1950s, John L. Cotter continued the field investigations as part of the Mission 66 program developed by the National Park Service to upgrade park facilities nationwide. Cotter’s development of a base map denoting every structure and feature that he and Harrington uncovered is still used today by archaeologists who continue to uncover Jamestown’s past.

Described below are Jamestown’s periods of prehistoric and historic occupation as organized from the findings of the APVA Jamestown Rediscovery™ project (initiated in 1994), the NPS Jamestown Archeological Assessment (1992-96), and from the draft documentation for the National Register of Historic Places (McCartney 2001). The draft National Register documentation addresses the eligibility and integrity of the cultural resources associated with Jamestown, grouped in four contexts: Prehistory, Settlement Era (1607-1745), Plantation Period (1746-1892), and Commemorative Period (1893-present). Each of these contexts is related to specific cultural themes identified by the NPS and Virginia’s State Historic Preservation

Officer (SHPO), head of the Virginia Department of Historic Resources (VDHR). The thematic framework of the NPS is outlined in *Revision of the National Park Service’s Thematic Framework* (1996a), and the department’s *Guidelines for Historic Contexts* (2000) identifies 18 cultural themes, some of which are related to archaeological and architectural features found at Jamestown.

In addition, the significant resources at Jamestown also represent the following themes: Peopling Places, Creating Social Institutions and Movements, Developing the American Economy, Expanding Science and Technology, Transforming the Environment, and Changing the Role of the United States in the World Community.

Prehistoric Use: American Indian Archaeological Resources

The archaeological record demonstrates human settlement on Jamestown Island for at least 10,000 years before the first European colonists arrived. Environmental changes, especially fluctuations in sea level, drove many of the population shifts and adaptations that are visible in the prehistoric record throughout the Chesapeake Bay estuary. Over time, short-term, seasonal occupation became the norm at Jamestown Island.

VDHR divides Virginia’s American Indian past into three broad cultural periods: Paleoindian, Archaic, and Woodland. These three periods encompass the era of Native American life in Virginia before Europeans arrived. Archaic and Woodland period archaeological sites occur on both Jamestown Island and its neighboring shorelines. Paleoindian sites, by comparison, are remarkably rare. The few Paleoindian artifacts recovered around the Island have been either random surface finds or artifacts from plow-disturbed contexts.

The Paleoindian Stage (12,000-10,000 BP)

Paleoindians are believed to have arrived in the region at the end of the Pleistocene. Forests then included plants now restricted to northerly latitudes in the United States, and sea level was as much as 300 feet lower than it is today.

Paleoindians are believed to have been small, mobile bands that ranged across a large but somewhat limited area. They typically established small, temporary encampments and moved from place to place based on the availability of food. Paleoindian sites are very rare in James City County and on the York-James Peninsula.

The Early Archaic Period (10,000-8500 BP)

During the Early Archaic, population density was low and small bands continued to use some of the same sites that Paleoindians had used. However, unlike the Paleoindians, Early Archaic groups established camps in interior uplands near wetlands. Locally, Early Archaic sites are nearly as rare as Paleoindian sites.

The Middle Archaic Period (8500-5000 BP)

The onset of the Middle Archaic period is marked by a distinctive evolutionary change in the regional environment. Changes in the distribution of local resources and increases in population are reflected in the use of interior upland areas. Although relatively few Middle Archaic period sites are part of the local archaeological record, it is probable that they are less visible because of the coastal flooding that has occurred since the end of the Pleistocene period.

The Late Archaic Period (5000-3200 BP)

By the time the Late Archaic period began, major estuaries and their tributaries had stabilized, making foodstuffs, especially aquatic resources, widely available. The transition from foraging to collecting resulted in the establishment of substantial semi-sedentary base camps along major streams, from which aquatic resources could be gathered. Hunting and gathering parties established small campsites while collecting other foods. Sites dating to the Late Archaic period

appear in appreciable numbers in James City County, with small encampments being the more abundant forms.

The Woodland Stage (3200-400 BP)

The Woodland Stage, a period of technological advances, included the introduction of ceramic vessels for cooking and food storage. In addition, the population increased significantly and more complex social organizations arose. By ca. 1000 BP, Woodland natives began supplementing their diet with semi-domesticated plants and eventually began cultivating corn, beans, and squash.

The Early Woodland Period (3200-2500 BP)

Although there was very little variation in the basic subsistence pattern between the Late Archaic and the Early Woodland periods, the technological advances made during the Early Woodland are an important distinguishing characteristic. Early Woodland sites are rare in James City County and elsewhere in the eastern portion of the York-James Peninsula.

The Middle Woodland Period (2500-1100 BP)

During this period, native populations appear to have made the transition from bands to tribal-level organization, and subsistence patterns began to evolve that eventually culminated in sedentary horticultural practices. There is increasing evidence of a distinctly regional cultural pattern. Numerous small Middle Woodland sites have been discovered in James City County, on interior drainages, and in nearby York County. Most of the Middle Woodland sites discovered locally appear to date to the early part of the period. As the Middle Woodland period drew to a close, cultural homogenization appears to have occurred.

The Late Woodland (1100-400 BP) and Protohistoric Periods

The Late Woodland period was characterized by a moderately intensive seasonal horticultural system that worked in sync with a sophisticated hunter-gatherer economy that was grounded in

the availability of local resources. At least half of all foods consisted of native plants and animals. Horticulture, an important component of life during the Late Woodland period, contributed dietary staples. Because maize, beans, and squash grew during spring and summer, the population was concentrated at village sites. During the Late Woodland period, social organization evolved to the point that tribes (probably consisting of no more than 1,000 people) were scattered throughout the coastal plain. By the mid- to late 16th century, a paramount chiefdom began to emerge. Powhatan, who inherited some of the tribes or petty chiefdoms under his control, gradually expanded his domain, eventually taking in approximately 32 groups.

In James City County, Late Woodland/Protohistoric sites have been identified, although they are less numerous than sites of the preceding period, probably because native people were concentrated at fewer but larger sites. Small Late Woodland sites also have been found. They probably represent procurement camps that were occupied by small hunter/gatherer groups. Late Woodland camps have been found in the county's interior, sometimes at sites that were occupied during the Middle Woodland period.

Historic Use

The following sections briefly describe the historic use of Jamestown, beginning with 1607, and provide a background for the establishment and significance of the historic structures, archaeological sites, and landscapes. The periods of historic use are divided into three sections: Settlement Era (1607-1745), Plantation Period (1745-1892), and Commemorative Period (1893-present). Figures 3-1 through 3-4 depict the relevant cultural resources referred to in the following sections.

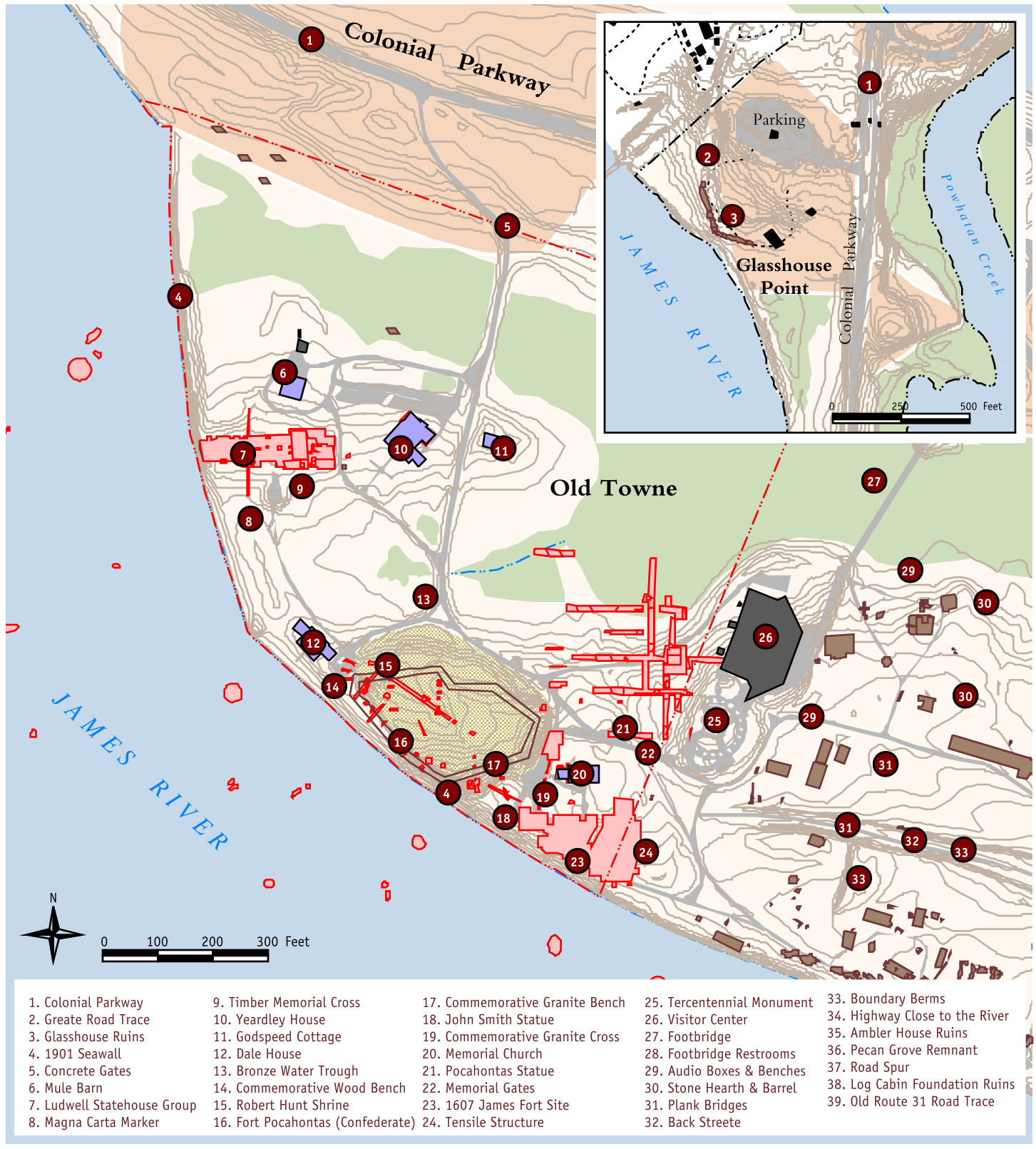
The Settlement Era (1607-1745)

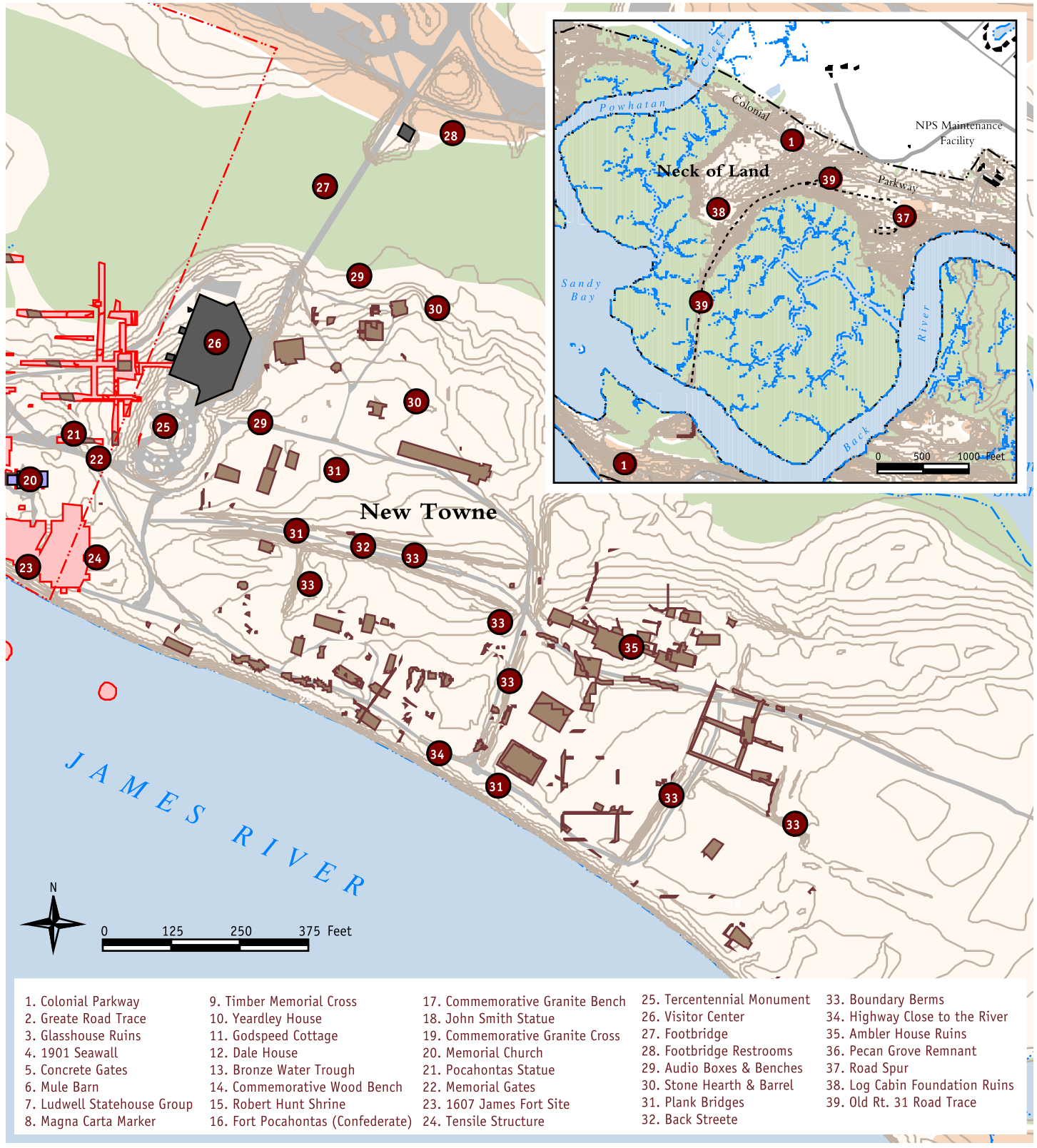
The Settlement Era is divided into three periods: the Virginia Company Years (1607-24), Jamestown as Virginia's Capital (1625-99), and the Later Colonial Period (1700-45).

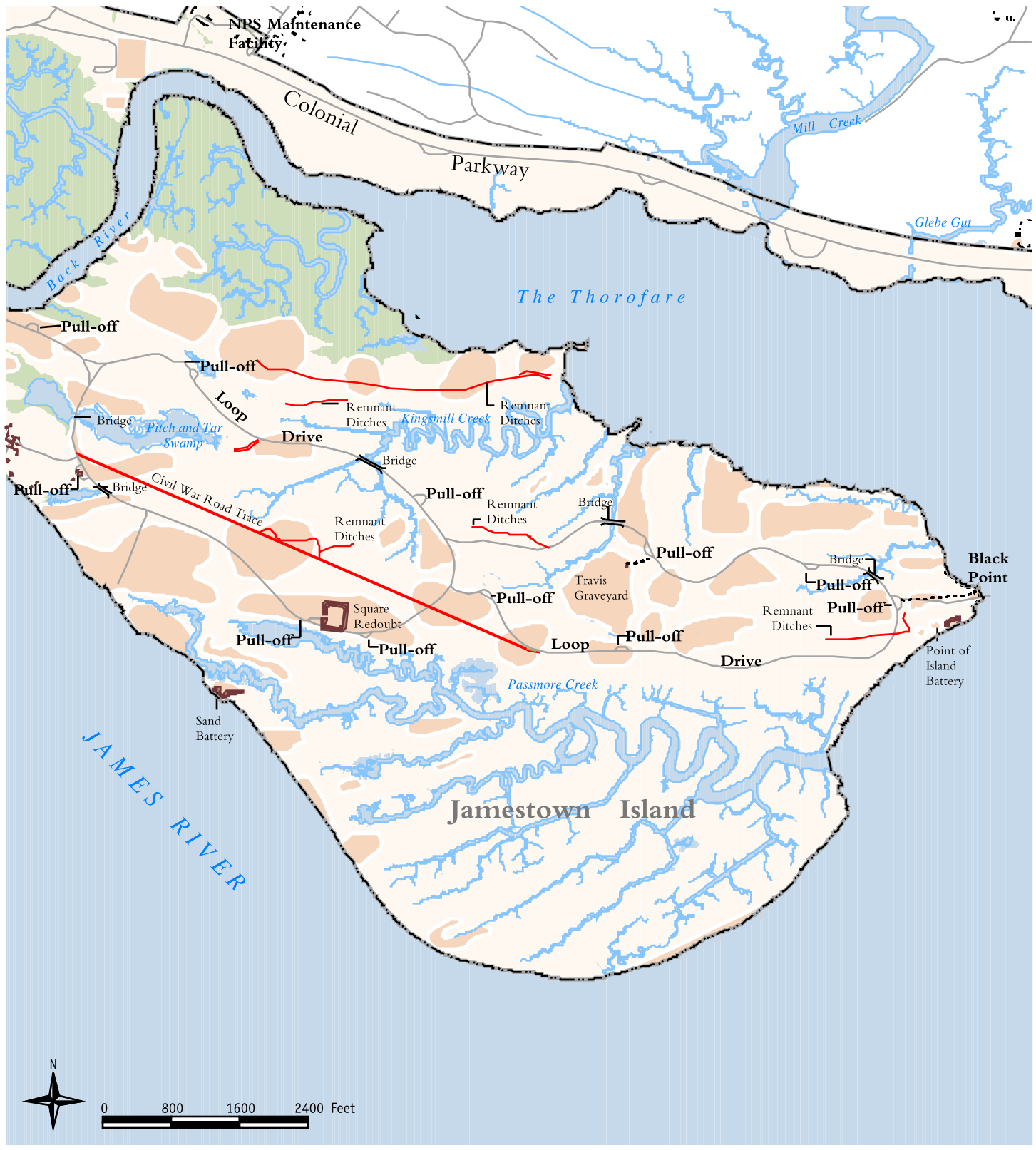
The Virginia Company Years (1607-24)

On May 13, 1607, three shiploads of English colonists landed on Jamestown Island and established the Colony of Virginia, with Jamestown as the capital, under a charter granted by James I to the Virginia Company in London. These first settlers immediately built a primitive half-moon fort to protect themselves from possible attack by the Spanish or American Indians. Within a month, they palisaded the fort and mounted ordnance. In 1608 the first English women arrived, and the colonists built a glasshouse on the mainland adjacent to the isthmus that connected the Island to the mainland. Germans and Poles were also brought over in 1608 to engage in glassmaking and potash operations. This area became known as Glasshouse Point.

After fire damaged the fort in 1608, it was repaired and expanded to protect 40 to 50 houses, the church, storehouse, and guardhouse. The worst drought in 800 years occurred between 1606 and 1612, reducing crops for both settlers and American Indians. The winter of 1609-10, known as the "Starving Time," nearly led to the colony's extinction as the majority of the colonists died. The APVA's Jamestown Rediscovery™ project found the 1607-23 fort long thought lost to the adjacent James River. This discovery dramatically changed the way Jamestown is now interpreted.







Legend

- Archaeological Sites
- Delineated Wetland
- Ditches & Road Traces
- Trails

Figure 3-3: Cultural Resources & Landscape Features

Loop Drive

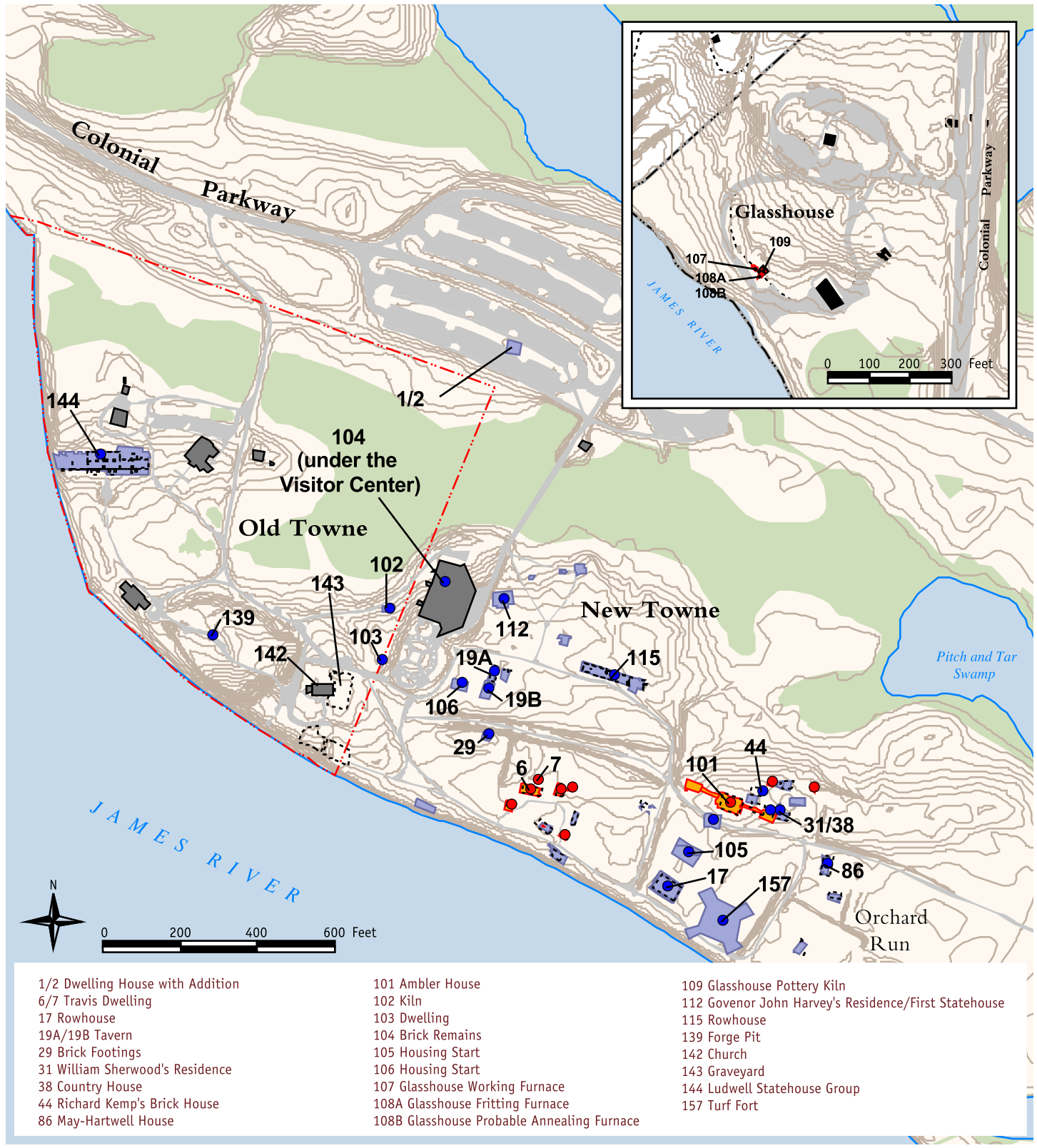


Figure 3-4: Archaeologically Identified Structures (Underground)

In 1610 the colonists left Jamestown, only to return in two days with the new resident governor, Lord De La Warr, who also brought with him more provisions and 250 new settlers. A year later, Sir Thomas Dale arrived with still more settlers. Attributing the colony's woes to inadequate leadership, Dale instituted martial law and oversaw construction of many new buildings, including shelters for livestock, storehouses for munitions and powder, and a blockhouse. Relations with the neighboring Powhatans, which had varied from friendly to hostile, improved somewhat during this period when John Rolfe married the Powhatan chief's daughter, Pocahontas, in 1614. Their union ushered in several years of peace, during which the colonists gained a firmer foothold in Virginia. Also during the Dale administration, Rolfe developed a strain of sweet-scented tobacco that quickly became the colony's highly lucrative cash crop.

In 1618 the Virginia Company ratified its Great Charter, which included the establishment of representative government and a system akin to local English law. Elected burgesses met in the church at Jamestown in 1619, the first such group to convene upon North American soil and the beginning of representative government in the Western Hemisphere. The Great Charter also ushered in a land policy that enabled the Virginia colonists to acquire real estate and work for personal gain, establishing the beginning of America's free enterprise system.

In 1619 a Dutch frigate arrived in Hampton Roads bearing about 20 Africans. First landing at Old Point Comfort, these men and women were brought up to Jamestown and sold into servitude. Initially, Africans and Europeans served their indentures, and both Virginia Indians and Africans were enslaved. But slavery soon became lifetime service, with descendants of slaves mandated to slave status. Thus the transition from a society with slaves to a slave society began.

At the Island's eastern end, the "Ancient Planters" patented more than a dozen 12-acre plots, some laid out before 1616, suggesting that this part of the Island was carved into small farmsteads quite early. The colonists had extended their settlement rather than huddling only on the Island's western end. The Phase I survey conducted as part of the *Jamestown Archeological Assessment* identified several such early 17th century sites that may be associated with certain Ancient Planters.

The Virginia Company's new land policy, known as the headright system, provided prospective immigrants an incentive to settle in Virginia by promising land to settlers. This policy granted 50 acres of land in the new colony to any immigrant who paid his or her passage and lived in Virginia for at least three years. Entrepreneurs who paid for another person's passage would also receive 50 acres for each indentured servant they funded. The policy stimulated so much development that between 1619 and 1623, investors received 44 grants for plantations. Other settlements grew in the area, including Wolstonholme, Henricus, and Flowerdew Hundred. By 1620, 117 people lived in James City, making it the largest of the colony's settlements. Although 32 Africans then lived in the colony and four American Indians were "in ye service of several planters" (McCartney 2000a), the specific locations of their residences remain unknown.

The Reverend Richard Buck, rector of the Jamestown church from 1610 to ca. 1623, was the first settler to buy in the area known as Neck of Land when he patented 750 acres in 1619-20. Other settlers received additional patents for this area; by 1624, 25 people lived there.

In 1624 the Virginia Company's royal charter was annulled, and Virginia became a crown colony in which the king appointed the colonial governor and council. The 1625 census indicates 175 people

lived on Jamestown Island. Jamestown had 21 houses, three stores, a church, and a large court of guard, with 10 more houses elsewhere on the Island. Although relatively little is known about Jamestown during the early 1620s, when it was a fledgling urban community, activities associated with church and state probably took place near the fort, where historical documentation locates the market-place, pillory, and whipping post. Meanwhile, development intensified and was encouraged in New Towne, east of the fort. The legislation designed to encourage building resulted in almost all of the very early patents for New Towne lots. Within New Towne, numerous buildings and cultural features dating to the first quarter of the 17th century have been found.

Jamestown as Virginia's Capital (1625-99)

By 1624 a row of lots in New Towne had been laid out along a road known as "The Highway Close To the River." John Jackson, a gunsmith, had a building in this vicinity that served as his home and workshop. Archaeological evidence of Jackson's gunsmithing activities has been found, as have features associated with activities involving John Harvey's waterfront property and the historic road. Back Streete, also identified archaeologically, ran at the rear of this first tier of lots with its own rows of developed lots. Throughout the Townsite, ditches and berms were constructed to mark property lines, exclude free-roaming livestock, and enclose other livestock.

In 1636 and 1639, legislation allocated a plot of ground for a house and garden to those who would build improvements on them. As a result, 12 new houses and stores were built in the town, including Richard Kemp's brick house (Structure 44). Other settlers contributed toward "the building of a brick church" (McCartney 2000a), presumably to replace a wooden one. Historical accounts claim that "there was not one foote of ground for half a mile altogether by the rivers side in Jamestown but was taken up and

undertaken to be built on" (McCartney 2000a). Other archaeologically identified houses built in this time include Structure 38 (the "country house") and Structure 112 (Governor John Harvey's residence).

In 1642 and 1643, legislation again offered land for housing and a garden as an incentive to build. In response, a flurry of patentees laid claim to small lots in the western end of the Island, some apparently not previously patented. It may have been shortly after, in 1645, that Governor William Berkeley erected the rowhouse at Jamestown that eventually became known as the Ludwell Statehouse Group, parts of which served as the colony's statehouse before 1655. New information is being gained through active archaeology and research at this site by the APVA's Jamestown Rediscovery™ project. A law enacted in 1649 designated as Jamestown's official marketplace all of the area between Sandy Bay and Orchard Run, from the James River to the Back River.

During the mid-1650s, several waterfront lots in Jamestown's New Towne were patented, as was land in the extreme eastern and western ends of Jamestown Island. In 1652 Edward Travis patented 196 acres in the eastern end of the Island near Black Point, consolidating some of the small tracts that had belonged to Ancient Planters more than a quarter-century earlier and adding on acreage he had obtained through headrights. Within a year he expanded his holdings to 326 acres, from the north side of Goose Hill Marsh to Black Point. The Traveses continued to acquire land and by 1682 had amassed 550 acres. The Travis plantation extended from Black Point westward across Passmore Creek to the property of Lancelot Elay, near Orchard Run. The Phase I survey conducted as part of the Jamestown Archeological Assessment identified the location of the Travis plantation's seat and its graveyard.

By 1657, 1,500 acres in the Neck of Land area came into the ownership of the Page family, which also owned land in Middle Plantation and Gloucester. Although the land continued to be farmed, a 1670 map shows no major plantation seat located within Neck of Land. In 1745, the Burwells of Carter's Grove Plantation purchased the property as a subsidiary farm managed by an overseer and farmed by enslaved Africans. Records indicate that by 1769 there were 29 African slaves, aged 16 or older, there.

Efforts to make Jamestown a proper English city continued with a 1662 act that promoted development by requiring the construction of 32 brick houses measuring 20 by 40 feet, along with various other structural specifications. New wooden houses could not be built, nor older frame buildings repaired. Documentary sources suggest that several of Jamestown's rowhouses and free-standing buildings were erected in response to this 1662 legislation, notably Structures 17 (rowhouse), 19 A/B (tavern), 86 (May-Hartwell house), 115 (rowhouse), and probably the housing starts, Structures 105 and 106. The first official statehouse was authorized during this building boom. It was located at former Governor John Harvey's house site (Structure 112). Prior to this, numerous other structures were used by the legislature and Governor's Council, including taverns and the Ludwell Statehouse Group (Structure 144).

By the early 1620s, the masters of all incoming ships were required to land their cargoes at Jamestown before going elsewhere. This policy, in effect through the 1660s, brought a steady stream of commerce here. Legislation enacted in September 1663 required townspeople to pull up all of the stakes" of the old wharves about the town" which were "soe prejudicial and dangerous to boats landing" (McCartney 2000a). They were also enjoined "not to build new ones in the face of the town" (McCartney 2000a), suggesting that wharves or docks then

protruded from a number of the lots along Jamestown's waterfront, probably the commercial district. Some of these features may survive beneath the tidal waters of the James River. Along the shoreline, numerous warehouses and at least two slave dealers operated.

In response to a 1667 Dutch attack on the English tobacco fleet in the James River off Newport News Point, only a few miles from Jamestown, England directed that fortifications should be built on each of the colony's major rivers. In November 1667, Governor Berkeley sent word to England that a turf fort at Jamestown was nearly finished. The remains of the turf fort have been identified archaeologically and designated Structure 157. A resumption of hostilities with the Dutch led the Virginia Assembly, in 1672, to order the construction of brick forts on all of the colony's major rivers. The turf fort was not reactivated then, probably because it was too far from the river channel to be effective. Instead, a 250-foot brick fort was built. The remains of the 1670s brick fort probably have been destroyed by erosion and dredging, with its location now submerged beneath the waters of the James River.

During the mid-1670s, Virginians were caught up in the popular uprising that became known as Bacon's Rebellion. Bacon's Rebellion has been attributed to several causes, including increasing economic problems, devastating weather (hailstorms, floods, and hurricanes) and American Indian attacks along the border. When Governor Berkeley failed to retaliate against the American Indians, Nathaniel Bacon, Jr., a member of the governor's council, led the colonists on raids against them. With strong public support, Bacon then turned against the governor and the council.

In 1676 Bacon's rebel army took up a position on the isthmus connecting Jamestown Island to the mainland, not far from Glasshouse Point. There, they constructed a "French work," a deep ditch

that consisted of earth, trees, and brush mounded into a steep embankment. Archaeological site 44JC106 may provide evidence of that earthwork. When the governor fled to Virginia's Eastern Shore, Bacon and his men entered Jamestown and burned it down. Some 16 to 18 houses were burned, as were the church (Structure 142), the statehouse (Structure 112), a tavern (Structure 19 A/B), the units of the Structure 115 rowhouse, and several other buildings. Late in 1676, Bacon abruptly died from illness and the uprising was quelled.

Because the statehouse (Structure 112) had been destroyed, the colony's officials began renting facilities for their meetings. One of the most frequently used sites was the Great Hall of William Sherwood's new brick house (Structure 31) in New Towne. Built around 1680, the house often served as a council chamber and the General Court; Sherwood also hosted the House of Burgesses periodically. The justices of James City County, who before the rebellion met in the General Court room of the statehouse, had to erect a building for their monthly court sessions.

In 1684 Philip Ludwell agreed to rebuild the statehouse and construct a prison as well. By November 1685 the new statehouse was usable and the House of Burgesses began meeting there. On October 20, 1698, fire destroyed the statehouse. Afterward, the governor and council and the General Court all met in Sherwood's house. Meanwhile, another house (the eastern end of Structure 115) was refitted to accommodate the House of Burgesses.

In 1699 Governor Francis Nicholson moved the seat of government to Williamsburg, justifying the move in part by noting that Jamestown could not accommodate the people attending both the General Assembly and the General Court. Contemporary counts claim between 20 and 35 houses then at Jamestown.

Later Colonial Period (1700-45)

In 1705 Virginia's assembly updated the colony's legal code to address its changing needs, then enacted several laws that affected all non-Europeans. Enslaved Africans were relegated to the status of "personal property" that could be bought and sold. Virginia Indians lost legal rights they formerly enjoyed, such as serving a public office or qualifying as a witness in legal cases.

At the turn of the 18th century, Edward Jaquelin, a merchant, immigrated to Virginia and married the widow of William Sherwood. In 1704 Jaquelin moved into the Sherwoods' house (Structure 31). He continued to add to his landholdings, purchasing 24 acres at Glasshouse Point in 1712 and a half-acre waterfront lot in New Towne in 1721. After his death in 1739, Jaquelin's Jamestown properties ultimately went to his daughter's husband, Richard Ambler. Ambler eventually consolidated several Jamestown Island parcels into an aggregate that he developed into a family seat. After his 1745 and 1753 land purchases, he built the Ambler House (Structure 101), a massive dwelling whose ruins remain today.

The Plantation Period (1745-1892)

The Plantation Period focuses on the transformation of Jamestown from a community to private ownership under the Ambler and Travis families and the use of Jamestown during the American Revolution and Civil War.

The Ambler and Travis Plantations

From 1745 to 1831, the Ambler and Travis families owned most of Jamestown Island in two working farm plantations. Both families also had residences in New Towne. The Amblers occupied Structure 101, which was built around 1753-56 and survived until the late 19th century. The Travises' townstead, consisting of Structures 6 and 7, dates to ca. 1755-80. The Travises also had an ancestral home and domestic complex (archaeological site 44JC900)

on their rural Island property. The Ambler and Travis urban residences had dependencies used for various purposes.

Documentary records show that a few other town lots had habitable structures. By the mid-18th century, the parishioners of James City Parish erected a new church on the mainland, although the abandoned Jamestown church and its yard remained church property.

By 1750 and until about 1758, Edward Champion Travis was involved in the slave trade bringing Africans to Virginia from Barbados. In 1755, he owned a half-acre waterfront lot in Jamestown, which may have been used in his slave business.

In 1775, during the American Revolution, the British invaded Hampton Roads, firing on Jamestown Island several times and hitting the Amblers' ferry house in the western end of the Island. The American troops stationed on Jamestown Island built a small battery in a ravine to the west of the church. During 1775 and 1776, military activity affected the Ambler plantation several times. In 1777 a Jamestown visitor noted the deteriorated condition of the Ambler house, mentioning an unfenced and neglected fruit orchard and fields abandoned to weeds.

British troops used Jamestown Island as a staging area in July 1781, when they withdrew across the James River after the battle of Green Spring. Later that year, allied troops occupied the Island, which was an exchange point for prisoners of war and a site where ships were outfitted for combat. Maps produced by French cartographers during the American Revolution suggest that the Ambler property on Jamestown Island had numerous buildings, with development concentrated near their manor house. Four buildings near the riverbank may have been part of the Amblers' mercantile operations. Jean Nicholas Desandrouins' 1781

map shows a curvilinear battery located in a low area, or swale, west of the church site, probably the same "vale" where a curved brick fort stood from 1673 to 1698.

In 1775, the British vessels shelled Jamestown, striking the chimney of Edward Champion Travis' kitchen. Travis later claimed that Virginia troops had severely damaged his dwelling and offices "at Jamestown" by using them as guardhouses. In 1779, when Travis died, his son inherited virtually all of his James City County property, including the plantation and townstead on Jamestown Island. By the end of the 18th century, the family owned 802 acres in the northeastern part of Jamestown Island and two or more lots in Jamestown. Apparently, crops were still cultivated at Glasshouse Point, known as the "Ambler on Main" plantation. In July 1781, British troops erected huts there, possibly as a base camp during temporary bridge construction across the isthmus.

After the American Revolution, John Ambler II resumed agricultural operations on his 900-acre plantation on the Island, raising corn, wheat and tobacco, as well as livestock. By 1790 it was a thriving plantation. Ambler finally built the much-needed causeway at the isthmus in 1798, allowing easier connections to the mainland again. In addition, Ambler and William Lee of Green Spring together built a low brick wall around the church graveyard, using the church wall ruins, sometime during the late 18th century.

Another family, the Burwells, cultivated corn and wheat, raised sheep, and cut timber on their 2,000-acre Neck of Land plantation. By 1782, William Holt had purchased the tract, and sold the parcel to John Allen in 1785. A map prepared by Francois Marie D'Abboville in 1781 shows the Neck of Land as wooded, rimmed by marsh, without any structures. However, on the 1781 Desandrouins map, the area is referred to as the "Neck Lands" and depicts a building that was located within a cleared area overlooking

Back River. It appears to have been in the immediate vicinity of archaeological sites 44JC1047 and 44JC1048 (Butts et al. 2001).

In July 1813, during the War of 1812, the British came ashore at Jamestown and looted the Ambler mansion, reportedly destroying anything they could not carry away. Steamboats regularly stopped at Jamestown Island during 1818, and documentary evidence suggests the Ambler house was used as an inn. In 1820-21 the Ambler plantation was sold and was probably leased to a tenant.

In 1821 David Bullock of Richmond bought the Ambler plantation and then the Travis plantation 10 years later. Real estate tax rolls from 1820 show that the Travises' 802-acre Jamestown Island plantation had no buildings valuable enough to be taxed. For the first time since European settlers arrived in 1607, the Island had one owner. The tax assessor described Jamestown Island as having 1,702 $\frac{3}{4}$ acres. Sometime after 1822, at the insistence of the Island's tenant farmers, the ferry, which previously had been moved from Orchard Run to Glasshouse Point around 1787, moved back to the Island.

In 1822, thousands attended the second formal commemoration of the first English colonists' arrival. (The first commemorative event at Jamestown Island was held in 1807.) Personal accounts described the landscape's condition: the Ambler house was in ruins, the fruit orchard no longer existed, and numerous ditches and abandoned Travis farm buildings remained. According to one observer, the celebrators, in their unbridled enthusiasm, "burnt down one of the two large brick houses on the island and broke the tombstones into fragments and scattered them over the face of the earth so that the whole island exhibited one wide field of desolation" (McCartney 2000a). A newspaper

account indicates that the building burned was the already uninhabitable Travis house (archaeological site 44JC900).

In 1832 the General Assembly authorized the construction of a toll bridge across Back River and the relocation of the ferry to the west end of Jamestown Island for the convenience of steamboats. Benson Lossing, who visited Jamestown in 1848, described the then-dilapidated bridge to the Island and a hurricane "a few years ago" (McCartney 2000a) that inundated much of the Island.

In 1836 David Bullock sold the Island to Goodrich Durfey, who practiced the latest scientific agricultural practices. Durfey had approximately 20 slaves and 12 horses, and he made substantial enough improvements that he boasted of having one of the best stock farms in eastern Virginia. In 1844, when Jamestown Island was advertised for sale, it had a large brick mansion, kitchen, laundry, dairy, smokehouse, an overseer's house, barns, stables, and slave quarters. Supposedly, the 2,000-acre farm had the best wheat soil in the state, grew clover, had fine peach and apple orchards, a lucrative steamboat wharf and ferry, and pasturage for 300 cattle. John Coke bought the Island and assigned an overseer to manage its operation.

In 1847 Martha Orgain, niece of the late William Allen of Claremont, bought Jamestown Island for her son, William, a minor and heir to Allen's fortune. William, who took his great uncle's surname, also inherited the Neck of Land Farms. According to an 1850 census, the agricultural operation on Jamestown by owner William Allen had expanded to include oats, dairy cows, oxen, and a new barn. About one-third of the Island's arable land was cultivated. Between 1852 and 1857, the value of the buildings on Jamestown Island rose from \$3,600 to \$4,200, making it one of James City County's most valuable farms.

Documentation reveals the condition of the town shoreline by the middle of the 19th century. In 1854, artist Robert Sully visited Jamestown Island and sketched the area around the churchyard, the ruins of the Travis house, and the eroded riverbank undermining the old powder magazine. An 1856 hydrographic map showed Jamestown Island with an extension of land identified as Church Point protruding from its western end, nearly reaching the James River channel. An 1873-74 topographic map shows the toll that severe erosion took on Church Point during the previous 17 years.

In 1857 the third major celebration commemorated the 250th anniversary of the first English colonists' arrival. A large refreshment saloon, a dining hall, cabins, and speakers' platforms built on the Island accommodated thousands of visitors. A large military encampment was also there. Hundreds of watercraft (including many steamboats) brought visitors to the Island with former President John Tyler as their speaker. At this point the Island was under intense cultivation; the 200 acres nearest the church ruins, for example, grew wheat. The graveyard and tower, surrounded by thickets, created a romantic landscape. In 1859 a congressional group visiting Jamestown Island planted ivy at the Church Tower's base—probably the first of several commemorative plantings within the Townsite.

During this period, Glasshouse Point and Neck of Land continued to be cultivated and grazed, with roughly 60 slaves laboring in these areas.

The Civil War (1861-65)

At the beginning of the war in 1861, the Confederates regarded Jamestown Island as the best point along the James River for defending Richmond, the South's capital and industrial center. Before the year ended, Jamestown had five earthworks that controlled river traffic and protected the Island. A small square Confederate redoubt was built along the Back

River. No military encampments seem to have occupied the Glasshouse Point area; however, Confederate troops were quartered in a large barn at Neck of Land. The remnants of most of the fortifications still remain, although one fortification was removed in the 1950s to construct the existing parking lot.

A new causeway, built in 1861, went from the southwest corner of Neck of Land, across the Back River and onto Jamestown Island. This route altered the main route to the Island for the next century. Because the new access road to the Island crossed from Neck of Land, the Greate Road, a former American Indian pathway that was used by the settlers as one of the first roads in English North America, became a dead end and was probably used only as a plantation farm road.

When Major General George B. McClellan launched his Peninsula campaign and besieged Yorktown in April 1861, the Confederates evacuated the Virginia Peninsula, including Jamestown. With Jamestown safely behind Union lines, the large federal transport fleet anchored there throughout the summer of 1862. Under federal occupation, Jamestown was a rendezvous point for escaped slaves, many of whom were evacuated by the Navy. When the Union army left the Island, William Allen's slaves burned the Ambler House, which he had owned since 1847. Between May 1862 and May 1863, the Neck of Land property became the base of operations for about 100 former slaves and free African-Americans.

During the final two years of the Civil War, Jamestown served as a Union outpost and communications link. An underwater telegraph cable ran 22 miles from Jamestown Island to Fort Powhatan and then to Lieutenant General Ulysses S. Grant's City Point headquarters during the Petersburg campaign, providing nearly instant communications between Washington, D.C., and the Union high

command. Nearly 40 years later, the Confederate military engineer who claimed responsibility for constructing the 1861 earthworks on Jamestown recalled seeing a mansion “not in very good repair, but entirely habitable, and the ruins of the old church.” He noted, “There may have been, and probably were, some small frame buildings at the shore end of the wharf.” He added, “the battery, which was built just above the old tower, was not far from the brink of the riverbank, which I understand . . . has been heavily encroached upon by the river” (McCartney 2000a).

Reconstruction and Postwar Growth (1865-92)

In 1868, William Allen sold the 1,391-acre Jamestown Island tract to two New Yorkers. Within a year, those owners had 600 acres under cultivation again. A large herd of livestock grazed freely throughout the Island. According to the 1870 agricultural census, people grew winter wheat and Indian corn, and raised cattle, sheep and swine. Descriptions also included “the dwellings, paper mill and improvements” on Jamestown Island.

A comprehensive 1873 topographic map (the Donn map) depicts the entire area in considerable detail. Four roads connected various parts of the Island. One farm road ran east-west, connecting the Travis cemetery and homestead with Black Point. A second east-west farm road connected the Ambler orchards with Kingsmill Creek. The main road ran east-west from New Towne to Black Point, linking the Travis landholdings with the western portion of the Island. Finally, the survey shows what appears to be a causeway where Passmore Creek meets the James River. The causeway crossed the creek south of the main Island road, connecting it to the eastern shoreline of the Island.

According to the survey, a road led from the western end of Jamestown Island (near the Church ruins) toward a bridge across Back River

and onto Neck of Land. It curved east, crossing the higher ground adjacent to the marsh, and then intersected a road (roughly equivalent to modern Neck-O-Land Road) that ran on a straight course into the mainland. West of that intersection a row of five buildings sat irregularly placed along the road’s south side with two more structures on its east side. The land passed through numerous owners but continued to be operated as a farm.

At Glasshouse Point, the Greate Road continued to be used for agricultural circulation, and the farm continued to cultivate cash crops. An additional small farm road leading east and terminating at Powhatan Creek is also found on the Donn map.

On May 14, 1877, a jubilee on the Island attracted a large number of visitors. Boats from Norfolk and Richmond made daily excursions to Jamestown throughout the summer.

The Commemorative Period (1893-Present)

The 40 years from 1893 to 1930, critical to the survival of Jamestown Island as a *historic site*, saw the first individual and organizational preservation efforts. The new private owners planned to make the area a tourist attraction. The APVA, established in 1889, had the preservation of Jamestown as its first and, then, primary mission. The private owners and the APVA together developed elements of a commemorative landscape still evident today.

The Barneys and the APVA

In 1892 Edward Barney and his wife, Louise, of Dayton, Ohio, bought Jamestown Island, excluding the Jamestown Church and graveyard. The Barneys, wealthy former industrialists, had plans to develop the Island as a tourist attraction. Since the abandonment of the Jamestown Island parish church and graveyard in the 18th century, that portion of the property belonged to the Commonwealth. In 1892 the General Assembly transferred

ownership of the church to the APVA. The legislature also granted the APVA the right to acquire additional land on Jamestown Island to allow access to the churchyard and gave APVA considerable discretion for acquisition. By May 13, 1893, the Barneys formally deeded 22.5 acres of Jamestown Island to the APVA. Included in the land were the Confederate Fort (Fort Pocahontas), the churchyard, an old dam, and a powder magazine fort. The acreage owned by the APVA has traditionally been called Old Towne.

A separate deed described each party's additional rights and privileges. The APVA received free use of the wharves and bridge that the Barneys intended to build. The Barneys received the rights to develop tourism on the Island, including the right to "furnish transportation for all excursions" (McCartney 2000a) to and from the Island. In addition, the APVA was not to construct any hotel, restaurant, or structure for entertainment. The Barneys and the APVA agreed to share the cost of constructing a wall to prevent erosion and collapse of the riverbank. Construction began in 1895 with granite breakwaters and wooden jetties; however, a damaging winter storm soon destroyed them. In 1901 construction of a concrete seawall began; it still protects the Island's southwestern shore. The seawall construction was an extremely important milestone in preserving cultural features of recognized importance in the nation's history. The United States government provided \$40,000 for the project administered by the APVA.

Barney developed tourism on the Island and also transformed the Island's agricultural uses to an expansive truck farm with systematic draining of the wetlands. In 1894 newspaper reports described the Island as being under intense cultivation, with wetlands dredged and replaced with grazing land. Around 1900 a pecan tree grove was planted as part of the new Jamestown Island Dairy and Fruit Farm.

Remnants of the grove still exist today at the eastern edge of New Towne.

By 1894 tourism facilities included a wharf and a large warehouse, with a storeroom and pavilion planned. A new artesian well had been installed, and a bridge and causeway linking the Island to the mainland were under construction. The Barneys also planned to put "an old fort" under glass. Laborers dug around the ruins along the waterfront and near the Ambler house and church, finding artifacts and subterranean brick "tunnels" (probably drains). Between 1901 and 1904, the APVA undertook its own archaeological investigations. Excavations on the APVA property explored the area behind the Church Tower and later the foundations of the Ludwell Statehouse Group.

The Virginia Navigation Company's massive palace steamer, *Pocahontas*, made regular stops at Jamestown Island, where guests enjoyed fresh fruit and vegetables grown on the Island. In March 1895, fire gutted the recently renovated Ambler house then occupied by an overseer for the Barneys—the fourth time the house had burned.

The 20th century brought considerable interest in commemorating the 300th anniversary of Jamestown's founding. The celebrations held in 1807, 1822, 1834, 1857, 1877, and 1895 had captured the public's interest. In 1903, the Jamestown Exposition Company received an appropriation of \$200,000 from the Virginia General Assembly to develop a site in Norfolk for the 1907 celebration.

By 1906 many commemorative and beautification plans were underway. The APVA planted shrubs, roses, and bulbs, and made some drainage and circulation improvements. The Association installed new pathways and access roads to link memorials and important structures. A granite marker, patterned after the Washington Monument, was erected near the old

Church Tower, on land the APVA deeded to the United States government. Descendants of Pocahontas commissioned a bronze statue of Pocahontas (installed 1922) and the APVA commissioned one of Captain John Smith (installed 1909). The 1899 Commemorative Granite Cross, honoring the patriotic services of the APVA members, still remains south of the church near the James River shoreline. In 1907 the APVA transferred one acre of land to the federal government for \$10,000. To memorialize the Tercentennial in 1907, the government erected an obelisk on this land, at a cost of \$50,000.

By 1907 smaller memorial landscape features – donations from various individuals and organizations with direct ties to early colonial events or people – marked the landscape. A pair of wrought iron Memorial Gates marked the boundary line between the Barney and APVA properties, adjacent to the tollhouse, with additional iron gates on concrete posts on the main road to Williamsburg. A granolithic drinking fountain, which served both humans and horses north of the Confederate Fort (Fort Pocahontas), and the First Assembly Monument – a stone monument to the first House of Burgesses, erected south of the Memorial Church – remain today. The APVA also completed an ambitious building plan. The Daughters of the American Revolution erected a memorial building, the Colonial Revival Yeardley House (now the APVA Jamestown Rediscovery™ Center). The Colonial Dames of America constructed a Memorial Church adjacent to the original Church Tower over the reputed original 1639 church foundations. A souvenir house constructed north of the Church Tower was used as a sales and post office for visitors. All but the souvenir house exist today.

Site and landscape improvements continued on APVA property after 1907. Records show that the Jamestown Committee for the APVA retained the services of well-known landscape architect

Warren Manning, who provided a master plan for the property. Manning had worked with the celebrated firm of Frederick Law Olmsted Sr. and continued the Olmsted-style design tradition of large park systems. He became known for designing beautiful and functional open spaces and coordinated closely with engineers in the areas of drainage and sanitation. In 1909 the APVA approved and adopted the final design plan that included circulation changes and many additional plantings.

By 1910 parts of the design were implemented, with the keeper's cabin in the Confederate Fort (Fort Pocahontas) torn down. A year later, the formal garden on the south side of the Yeardley House was laid out and a large tree-planting campaign began. The Richmond City Council donated 108 willow oaks and 24 crape myrtles. In 1914, the APVA planted willows and Roanoke hickories near the “low end of the swamp” (McCartney 2000a) and crimson mallows along the banks of the transverse ditch crossing the swamp.

In 1914, the last phase of the Manning plan was installed. A raised road encircled the grounds connecting the drinking fountain, the “Rest” House (Dale House), the Yeardley House, and the archaeological excavations. Although further research and analysis needs to be done, this road system seems to be the strongest design feature from Manning's plan that remains today.

In 1918, the Virginia General Assembly underwrote the rebuilding of the bridge and causeway across Back River. Edward and Louise Barney had begun constructing the bridge and causeway on the Neck of Land, linking the Island to the mainland, in 1897. Landscape improvements continued until 1930 on the APVA property. In 1920 the APVA planted several fruit trees, pecan trees, shrubs, and a Cedar of Lebanon. That same year, two acres of corn planted in the northeastern corner of the property replaced weeds, and a meadow north of the

Yeardley House was cleared. In 1922, the Robert Hunt Shrine was installed on the southern interior embankment of the Confederate Fort (Fort Pocahontas), adjacent to the shoreline. The Daughters of Colonial Wars presented a granite memorial seat in 1929. Records also show that a bathhouse and snack bar were built on the Barney property between 1923 and 1930.

A Federal-Private Partnership

In 1929 the state and federal governments collaborated in the construction of a wharf and pier. The APVA made plans for excursion boats to land there and built a small entrance building close by.

In January 1930, Rep. Louis C. Crampton introduced a bill into the House of Representatives that authorized the secretary of the interior to designate historic sites in Jamestown, Yorktown, and part of Williamsburg as the Colonial National Monument. He also proposed to link all three areas with a scenic road (now known as the Colonial Parkway). Despite much local opposition, Congress passed a modified version of the Crampton bill, which provided for acquiring land in Jamestown and Yorktown to create the national monument (Public Law 510, 71st Congress; 46 Stat. 855). Other planned changes included building a breakwater around Jamestown Island, draining some of its marshes, and planting shrubs and trees to control erosion. Consideration was given to restoring the Island's historic buildings. On June 5, 1936, Congress redesignated Colonial National Monument as Colonial National Historical Park (Public Law 666, 74th Congress; 49 Stat. 1483).

During 1931 an estimated 36,000 tourists visited Jamestown Island, which held commemorative events every spring. Efforts to improve existing facilities began immediately. Students from the Riordan Boys School of Highland, New York paid for a new artesian well, a shelter, and a

platform, and they planted 1,000 trees sent by the New York Conservation Commission.

In 1932 an act of Congress authorized acquisition of all of Jamestown Island, except the 22.5 acres owned by the APVA, to be managed by the National Park Service. A year later, the NPS recorded an inventory of landscape features on the old Barney property. Twentieth century structures still there included a small log cabin, a souvenir stand, a small brick souvenir and lunch stand, a star-shaped log cabin, a frame bathhouse, an H-shaped log cabin, a small frame dwelling, a medium-sized wooden barn, two small wooden cabins, and two small wooden toilets. Many of these buildings were razed in 1934 to prepare for archaeological research.

Since 1934, the NPS and APVA have jointly administered Jamestown Island and its historic sites. Beginning in 1935, the National Park Service initiated two major land management programs. The first began a formal campaign to restore wildlife to the Island, bringing in hay and grain as food for deer, turkey, quail, and small animals. The program was so successful that illegal hunting became a problem by the mid-1940s. Second, from 1935 to 1936, Civilian Conservation Corps members worked to clean up Jamestown Island and control its erosion. During the CCC's four years of work at Jamestown, the men, who were African-American, improved its maintenance and conservation, including the placement of riprap from the eastern end of the seawall to just east of Orchard Run.

Major planning and construction projects took place from 1936-40 on both the NPS and APVA properties. The APVA completely renovated the Yeardley House: four new outbuildings replaced old ones. The Godspeed Cottage, built in 1933, moved in 1939 to its present location on higher ground. New electrical lines served all the major buildings.

The first Master Plan for the federal property, presented in 1936, called for constructing public contact buildings to meet visitors from the ferry. This complex included a parking area, comfort station, picnic grounds, and a small museum. By 1937 these structures and an archaeological lab were built.

The CCC began excavations on Jamestown Island under the direction of architectural historian Henry Chandlee Foreman and archaeologists John T. Zaharov, H. Summerfield Day, Alonzo W. Pond, and W.J. Winter. In 1936 J.C. Harrington, an experienced archaeologist, arrived at Jamestown and took over the excavations in 1937. During this period, traces of the Greate Road were found. With the onset of World War II, the CCC program and its excavations ended.

The 1941 Master Plan addressed the new cooperative agreement between the APVA and the NPS. The agreement called for a joint ticket entrance fee and for combined archaeological research. In 1941 formal efforts at interpreting the New Towne landscape began. The museum displayed an earlier interpretation of archaeological findings. This interpretive program used the ditches and paths, exposed foundations, and markers from the archaeological digs.

The advent of World War II stalled work for both organizations. Between 1942 and 1946 the ferry moved masses of workers. The U.S. Coast Guard Artillery occupied the Godspeed Cottage as a lookout post. The APVA made limited repairs and improvements to its structures with an addition to the gatehouse, removal of an old shop, and remodeling of the barn and stable. The rose garden at the Yeardley House was completely replanted.

In 1947, the NPS acquired the Dimmick and 4-H Club parcels at Glasshouse Point with at least 25 camp-style structures and two roads on these

additions. From 1948 to 1949, J.C. Harrington undertook excavations to find the original glasshouse kilns. He identified a number of stone furnace foundations that are still displayed today. Shortly after its establishment, the Jamestown Glasshouse Foundation erected a wooden and bronze monument next to the site.

By 1956, the construction of new furnaces for an interpretive structure began. Part of the Greate Road trace was reconstructed and surfaced with oyster shells. A path system connected all these features with the new parking lot. In addition, a small service building now known as the Harrington House was located northeast of the new Glasshouse. Finally, a new welcome station was built in the Colonial Parkway's median just before the entrance to the Glasshouse Point parking lot.

After the war, activities at Jamestown resumed. In the 1950s, the National Park Service launched its Mission 66 program to revitalize the parks and their visitor facilities. For Colonial National Historical Park this program could not have been timed better, since new facilities needed to be built in time for the 350th anniversary commemoration in 1957. Colonial NHP built new visitor centers at Jamestown and Yorktown and completed the Colonial Parkway connecting the two. The changes included moving the ferry landing to its present location adjacent to the Jamestown Settlement, moving Virginia Route 31 and removing its bridge between the Island and Neck of Land, and reconstructing the 17th century causeway linking the Island with the mainland. Route 31's previous roadbed across the Neck of Land remains clearly visible today. Additional facilities at Jamestown included new Glasshouse Point parking, interpretive site, and comfort station and maintenance facilities at Neck of Land.

In 1956 the NPS/APVA Visitor Center at Jamestown opened with inside exhibits, an audiovisual presentation, and a gift shop. The steps

around the Tercentennial Monument were backfilled and a new observation terrace constructed. A new service road linked the Visitor Center to the Confederate Fort (Fort Pocahontas). The exterior landscape interpretive exhibits included brick outlines of buildings excavated on the Townsite and a new parking lot. During the Bicentennial of the American Revolution, the Visitor Center was expanded, and the exhibits changed.

On the New Towne site, NPS landscape architects designed a landscape in an effort to interpret the layout of the original Townsite. Based on extensive NPS archaeological excavations from 1954 to 1956, the original Back Streete realignment, property line ditches, and fences were reconstructed with walks and plantings. Faux brick delineations built over their archaeological counterparts were painted white to reflect the spatial character of those buildings. Sidney King paintings, interpretive texts, and audio stations placed in benches (then the latest in interpretive technology) were installed in New Towne and Old Towne.

A memorial wooden cross on a brick pedestal was erected adjacent to the gravesite within the Ludwell Statehouse Group. With the removal of the 7-foot-tall wire fence that separated the APVA and NPS properties since 1931, free movement between the two Jamestown Island properties was re-established.

A tour road, the five-mile Loop Drive, was designed to provide visitors a sense of a 17th century road. Designed specifically for automobiles, the Loop Drive's pull-offs had large Sidney King paintings installed in weatherproof panels to provide visitors information about commercial activities attempted by the early colonists. Only two pedestrian trails, both leading from road pull-offs, were developed along this road system: one trail leading to the Travis Graveyard and the other to Black Point.

With the removal of Route 31 and the construction of the Parkway and NPS Maintenance Facility, the spatial character at Neck of Land changed significantly. Floyd Ayers had sold 64 acres to the United States government in 1935, and in preparation for construction in this area, park archaeologist John Cotter surveyed Neck of Land for archaeological sites. A large frame house and barn structures still stood at the time.

To avoid constructing a replica of the 1607 James Fort on the original site, the NPS, under an act of Congress, deeded 10 acres to the Commonwealth of Virginia to construct a replica fort and Indian village. The 1956 legislation stated that the land was to be used "in furtherance of the purposes of Colonial National Historical Park" (P.L. 84-448). The Commonwealth opened Jamestown Festival Park (since renamed the Jamestown Settlement) during the 350th anniversary commemoration.

Several changes have occurred on Jamestown Island since the 350th anniversary. Beginning in 1958, the APVA relocated several of its memorial structures, moving the Memorial Gates to the north side of the church and the Robert Hunt Shrine from the southern flank of the Confederate Fort (Fort Pocahontas) to its current location inside the fort. The Pocahontas statue moved from its former prominence next to the John Smith statue to the path just west of the Memorial Gates and onto a large rock. The APVA added two landscape features, placing a rough-hewn stone chair, the Powhatan Seat, next to the Pocahontas statue in 1959 and planting boxwoods from the Berkeley Plantation in front of the Yeardley House in 1964.

In the 1970s, in preparation for the Bicentennial of the American Revolution, the National Park Service expanded the 1956 Visitor Center, adding a large lobby with floor-to-ceiling windows and additional space for the museum

gift shop and exhibit space. A terrace constructed on the eastern side of the Visitor Center allowed direct access into the building from the parking lot via a pedestrian bridge. In addition, a cast aluminum interpretive sign, contributed by the Glass Packaging Institute, was erected at Glasshouse Point in 1974.

During the 1990s, the NPS Jamestown Archeological Assessment and the APVA's Jamestown Rediscovery™ project undertook major research projects in anticipation of Jamestown's 400th anniversary commemoration in 2007. The JAA research involved an NPS cooperative agreement with the Colonial Williamsburg Foundation and the College of William and Mary, which conducted the first ever Island-wide survey. Both the APVA and NPS projects made many crucial discoveries, which are dramatically changing the way historians view the first settlers. Most notably, locating the 1607 fort long believed lost to the James River and the associated artifacts has increased our understanding of the interaction of the European settlers with the Virginia Indians, as well as contradict some of the earlier assumptions about the settlement. For the first time, a comprehensive, systematic survey was completed of the Island. The JAA research established the relationship of the natural environment to historical events, documented four centuries of land ownership patterns, and placed the Island into its historical context.

In 1999 a second wing added to the north side of the Yeardley House (renamed the Jamestown Rediscovery™ Center) provided additional storage and workspace for the APVA archaeological collections.

3.3.1.2 Ethnographic Resources

In accordance with Director's Order 28 and the Cultural Resource Management Guidelines (CRMG), ethnographic resources associated with Jamestown were identified and considered. In

identifying the associated groups and related sources, the existing social, ethnic, religious, and kinship groups who frequent Jamestown Island and regard it as a critical facet of their own group identity and vitality were considered by Dr. Andrew Veech, the park's archaeologist, in consultation with Dr. Julia Steele, the park's ethnography reviewer. (Veech 2002) The following "traditionally associated" groups were identified: American Indians, African/African-Americans, Descendants of Previous Inhabitants, and Jamestown Memorial Church Parishioners.

The 21st century American Indians who represent the eight state-recognized tribes now living in Virginia are: the Chickahominy of Providence Forge, the Eastern Chickahominy of Providence Forge, the Mattaponi of West Point, the Monacan of Madison Heights, the Nansemond of Chesapeake, the Pamunkey of King William, the Rappahannock of Indian Neck, and Upper Mattaponi of Mechanicsville. Of these eight tribes, four claim direct lineal and consanguineous² ties to the 17th century Powhatan chiefdom: the Mattaponi, the Nansemond, the Pamunkey, and the Upper Mattaponi.

NPS officials have forged and maintained close communications with the Virginia Indian Council and solicited comments from them throughout the planning process for Jamestown. In 2001, tribal members were invited to a series of stakeholders' meetings intended as a forum for voicing concerns and opinions about Jamestown. None of the tribal representatives declared any present-day claims to Jamestown Island. Rather, the representatives acknowledged that their ancestors permanently abandoned the Island once English colonists settled there in 1607. Similarly, no American Indian group now conducts any of its traditional subsistence or ritual activities on Jamestown Island or regards the Island as vital to its group identity.

² Blood or ancestral.

In 1619, the arrival of the first Africans to Jamestown began the saga of enslavement that transcended three centuries. Africans and their descendants worked in bondage for those who lived and worked in Jamestown until emancipated by the Civil War. During the CCC era of development, African-Americans were part of the workforce that assisted park archaeologists with excavations and processing of the artifacts. They also constructed the rip-rap barrier along the riverfront, planted trees and grass, and served as weekend security guards.

Stakeholder meetings held with the African-American community in the Hampton Roads area on planning for Jamestown brought forth recommendations to expand the interpretation of the 17th century African-American experience and the role of Jamestown in the enslavement of this group. None of the African-Americans who attended the meetings declared any present-day claims to Jamestown Island nor do they conduct any of their traditional subsistence or ritual activities on Jamestown Island or regards the Island as vital to its group identity. The colonial Jamestown story is one of the encounters of three distinct cultures: European, American Indian, and African.

While there are numerous groups that were established to honor the memory of their ancestors who were among the first settlers to Jamestown, they have not established a traditional pattern or have been associating on NPS lands for more than two generations. Descendants of the Travis Family, which resided on the Island from 1682 until May 1822, return periodically to the family cemetery and leave flowers. While the descendants do not claim ownership of the manor house site or the cemetery, they regard unencumbered access to these sites as vital to their continued family connection and sense of shared family heritage. These Travis family descendants are considered to be a genuine ethnographic resource of Jamestown Island in accordance with the following CRM criteria: 1) they are a kinship group, and 2) they have been

associating on NPS lands for more than two generations.

The last ethnographic resource considered was the Jamestown Memorial Church Parishioners on APVA property. The Church was constructed in 1907 and has functioned as a house of worship since then. Although technically not a fully consecrated church within the Diocese of Southern Virginia, the Memorial Church nevertheless is used as a site of routine Episcopalian worship services every Sunday at noon, as well as the annual Easter sunrise service. Because of the longevity and continuity of worship within the 1907 Memorial Church, its congregants are considered to be a legitimate ethnographic resource of Jamestown Island, in accordance with CRMG that states “cultural systems include expressive elements that celebrate or record significant events and may carry considerable symbolic and emotional weight. These include rituals.”

3.3.1.3 Archaeological Sites

Figures 3-1 through 3-4 depict relevant cultural resources discussed below. For organizational purposes, sites are divided into four geographical areas: Townsite (Old Towne and New Towne), the Loop Drive, Glasshouse Point, and Neck of Land.

Townsite

The NPS and APVA properties are associated with archaeological sites that date from the 17th century through the 20th century. Prehistoric artifacts and sites have also been discovered on both properties. Old Towne (APVA) and New Towne (NPS) contain the densest concentration of archaeological remains on Jamestown Island. Most of these remains are of English cultural origin and date to the 17th century, associated either with the Jamestown colony’s founding or with the later flowering and growth of that colony into a modestly prosperous port community and colonial capital. Although this urban settlement effectively died with the 1699 transfer of government to Williamsburg, it was never forgotten. Nostalgic, patriotic commemorations of the early

Jamestown settlers have been conducted at Jamestown since at least 1807.

Old Towne and New Towne are the most extensively documented and intensively examined archaeological zones on Jamestown Island. Historically, they have also been the primary location of development to support commemorative activities and visitor services. Although some sites in New Towne sustained damage from the excavation techniques used in the 1930s and 1950s, archaeological tests conducted along the James River waterfront, specifically within the area protected by riprap, show that many intact cultural deposits remain. Likewise, archaeological tests using noninvasive techniques (such as remote sensing) and limited excavations elsewhere in New Towne have determined that undisturbed cultural features remain throughout the NPS property.

Old Towne

The grounds owned by the APVA on Jamestown Island have been investigated archaeologically for more than 100 years, representing the evolution of historical archaeology from antiquarianism into a professional discipline with standardized methods. Antiquarians working on the APVA property during the late 19th and early 20th centuries examined cultural features associated with the church (Structure 142), the graveyard (Structure 143), and the Ludwell Statehouse Group (Structure 144).

Beginning in 1901, the APVA constructed a protective seawall and excavated the church foundations east of the church tower. These investigations revealed the presence of two foundations, thought to date to 1617 and 1639, and a number of graves. The National Society of Colonial Dames of America decided to construct the Memorial Church in 1907 on top of the north and south wall foundations of the first brick church (the fourth church) for the 300th anniversary of the founding of Jamestown.

Colonel Samuel Yonge, the engineer for the seawall, excavated and recorded a five-part brick foundation (Structure 144) northwest of the 1861 Confederate Fort, in 1901. He noted in his 1907 book, *The Site of Old "James Towne" 1607-1698*, that the eastern end of the structure may have housed government functions. While a plan of the foundations was drawn, no known record of the excavation exists to determine the dates of the deposits and the character of the buildings. Subsequently, the foundations were capped with concrete and fenced in for exhibition.

From its acquisition of the rest of the Island in 1934 until 1941, the National Park Service conducted a series of exploratory excavations on the APVA tract, as well as on the NPS-owned acreage. On the APVA land, trenching revealed the location of five segments of the Great Road, which led westward from Jamestown to the mainland, west of the Tercentennial Monument. Excavations in 1941 by J. C. Harrington also located three graves, a kiln, two structures, ditches, and other unidentified features, all just north and west of the monument. The kiln (Structure 102), a large brick and flat roofing-tile kiln, probably operated in the middle 17th century and was abandoned by 1694. Structures 103 (dwelling) and 104 (brick remains) – neither fully explored nor recorded – were possibly constructed and occupied in the 18th century.

The National Park Service once again focused attention on Jamestown from 1954 to 1956 to prepare for the 350th anniversary of the founding. Although excavations concentrated on the 13-acre New Towne area east of the monument, NPS also searched several locations on the APVA land and in the bordering James River. In 1955, Joel L. Shiner, under the direction of John Cotter, undertook three projects to find the first fort of 1607, two of which were on APVA property. While he found no trace of the original fort in these investigations, he recorded important information regarding the condition of these areas. Project 100 searched the area from the Confederate Fort to the seawall. It was hoped that the Confederate

earthwork had protected traces of the fort because early 17th century artifacts, including arms and armor, were found during the 1861 fort construction. The investigations indicated that earth for construction was obtained from the inside and outside of the fort, as the areas tested had soil previously removed to level of subsoil.

Nevertheless, Structure 139 (a forge pit) was found within the 1861 fort, and it contained parts of guns and swords thought to date to before 1620. In addition, a test in the south side of the Confederate Fort identified three discrete occupation zones from top to bottom: Confederate Fort fill, a 17th century layer, and an American Indian layer. Shiner suggested that the crisp transition between the American Indian and the 17th century layers indicated that the former occupants had left not more than 20 years before 1607.

Project 232, undertaken in 1955, searched for the 1607 fort. Archaeologists covered the area between the seawall and the James River channel, starting from the ferry wharf, near the church, to an area just north of the five-part brick foundation (Ludwell Statehouse Group) investigated by Colonel Yonge in 1901. Conducted by a power-operated clam bucket on a barge, the 65 tests found no evidence of the fort. While bucket drops were planned parallel to and 50, 100, 150, and 200 feet from shore, implementation resulted in irregular bucket drops, though still uniformly scattered.

The only other major NPS investigations on APVA property in 1955 were those conducted by Joel Shiner in the Ludwell Statehouse Group area. The uncovering of the previously excavated area to create measured drawings accidentally showed the presence of numerous graves beneath the foundations. As a result, Project 105 was undertaken to examine the extent of the graveyard. Seventy burials were found between the James River and the Jamestown Rediscovery™ Center; some researches have suspected it to be the site of 300 graves, possibly dating from the Starving Time of 1609-10.

In 1994, the APVA initiated its own program of archaeology, Jamestown Rediscovery™, which continues to the present. Under the direction of Dr. William M. Kelso, the Jamestown Rediscovery™ project's overall goal is to find and selectively excavate the remains of the first Jamestown settlement, particularly the original James Fort, and its evolution during the Virginia Company period of 1607-24. The project has been extremely successful. The southeast corner of the original 1607-23 fort, consisting of evidence for a slot trench seating side-by-side log palisades flanked by a dry moat, has been found. These features and others in the environs have yielded dated artifacts and closely dateable assemblages from the 1607-10 occupation. More recently, structures and features from later periods in the 17th century have been found and excavated. All of these investigations have employed "area" excavations, in which large sections of the site are exposed to the level of subsoil for the full delineation and selective excavation of cultural deposits. Portions of the site have been backfilled, the elevation raised, and a section of the palisade has been reconstructed above the slot trench.

New Towne

Under the Jamestown Archeological Assessment, archaeologists from the Colonial Williamsburg Foundation examined and carefully mapped the locations of some of the 17th century sites excavated in New Towne during the 1930s and 1950s. These earlier excavations located numerous foundations, wells, boundary ditches, and roads, resulting in more than 600,000 artifacts. Architectural historians from the Colonial Williamsburg Foundation reviewed excavation records and hundreds of thousands of artifacts pertaining to structures in New Towne, reinterpreting the archaeological data found during the 1930s and 1950s. This work, in conjunction with the documentary research, provided a new understanding of the haphazard nature of the development of New Towne in the 17th century.

The remains of the Ambler plantation are the most significant 18th century resource in New Towne. A complete archaeological investigation of the site, along with its 17th century components, has yet to be completed. Eighteenth century sites in Old Towne have not been clearly identified; however, it is suspected that occupation of Old Towne during the 18th century did occur.

The late 19th and 20th centuries are abundantly represented on Jamestown Island, typically by subsurface cultural deposits usually created for special purposes. Near the Townsite are dumps believed to be associated with the CCC and other activities connected with the development of Jamestown Island into a public park. Debris found on the upland fringes of the Island is probably the result of modern-day hunting and fishing activities. Throughout the Island, ditches, roads, and berms were constructed for various special uses.

Additional Sites Near the Townsite

The 1994-95 Phase I archaeological survey (Blanton et al. 2000) of Jamestown Island found additional sites associated with the Townsite near Orchard Run and north of the Pitch and Tar Swamp toward Back River. These sites contain both prehistoric and historic components. The sites include the following:

- Site 44JC924, a multi-component site, contains both Late Woodland and Protohistoric American Indian materials and historic-period features dating to either the 17th or 18th centuries. The site has been affected within the past century by the construction of a riprap barrier. Historic-period features, still visible on the ground surface today, include road traces and boundary ditches. The site eventually became part of the Ambler plantation.
- Site 44JC927, a multi-component site, contains both prehistoric American Indian and historic-period materials. The sparse American Indian

materials date to either the Middle Woodland or Late Woodland period and suggest an encampment. Historic-period artifacts imply nondomestic activities may have occurred there during the 17th century. This site also became part of the Ambler plantation.

- Site 44JC928, a multi-component site, contains prehistoric American Indian materials dating to either the Middle Woodland or Late Woodland period and suggests only short-term use of the site by American Indians. Historic-period components date from the 17th through the 20th centuries. The site's 18th century component may have been a structure depicted on Jean Nicholas Desandrouins' 1781 map. The 17th century component is potentially of great significance, even though it may be partially disturbed. Eventually, the land became part of the Ambler plantation.
- Site 44JC929, a multi-component site, contains predominantly colonial-period materials, together with a comparatively sparse number of prehistoric American Indian materials. Evidence of domestic occupation at the site is minimal. Features at the site include a narrow, in-filled swale, which may have provided access to New Towne. This swale sits near "Mr. Knowles brick bridge," identified on a 1664 land plat (McCartney 2000a) and rediscovered by John Cotter during his 1950s excavations. The swale may be a remnant of "the highway leading into the parke" (McCartney 2000a) that existed before 1625. Eventually, this site also became part of the Ambler plantation.
- Site 44JC930 contains a minimal prehistoric American Indian component and more substantial historic-period components dating to the 17th, 19th, and 20th centuries. One of the site's most prominent historic-period components includes Structure 1, a 17th

century dwelling house excavated in 1934, and Structure 2, an addition to Structure 1. Other notable structures within the site include two wells.

- Site 44JC931 is a multi-component site impacted by the early 20th century construction of the Jamestown Island seawall. The seawall has protected the site from erosion, but obscures the site's prehistoric American Indian component. No diagnostic prehistoric artifacts have yet been recovered. Early colonial-period artifacts have been identified and indicate domestic occupation. This site holds considerable research potential.
- Site 44JC932 contains a small, prehistoric American Indian component and historic-period components dating to the 19th and 20th centuries. The site was impacted by the construction of old State Route 31 when it crossed from Neck of Land to Jamestown Island. A prominent 19th century feature at 44JC932 is the so-called "Bridge Lunette," a small Confederate earthwork constructed during the Civil War.

Loop Drive

Forty-nine of the 58 sites discovered during the 1994-95 Phase I archaeological survey of Jamestown Island conducted by the College of William & Mary's Center for Archaeological Research (Blanton et al. 2000) contain prehistoric American Indian components yielding artifacts ranging the entire span of Virginia's prehistory—from the Paleoindian period through to the era of European contact. Thirty-nine of the sites contain potentially significant historic-period components; of these, 20 date to the 17th century. The 17th century sites were distributed throughout Jamestown Island, with approximately 12 found in locations beside the James or Back Rivers. Nine historic-period sites date to the early to mid-18th century or have 18th century components. Some sites cannot be assigned to a specific period without more extensive testing.

Sites that may be affected by construction along the Loop Drive, including new pulloffs and new interpretive signs, are described below.

- Site 44JC890 contains an ephemeral prehistoric component indicating brief American Indian occupation. A historic-period component postdates the 1740s and likely is associated with the Travis plantation. A large ditch and berm, located to the west, may be a field or property boundary marker. During the 1620s the northeasterly part of the site belonged to John Southern, and the southwesterly part belonged to "Ancient Planter" Thomas Passmore. By 1652 the site was part of the Travis plantation and remained in the Travis family until 1831.
- Site 44JC891 contains both a prehistoric American Indian component and a historic-period component dating from the 17th through early 18th centuries. The site's American Indian component most likely dates to the Late Woodland period. The site includes the remains of a 17th century structure that probably was a dwelling, given its preponderance of domestic artifacts. Two large ditches most likely mark a property boundary line. By 1672 this site was also part of the Travis plantation and remained in the family until 1831.
- Site 44JC897 contains a prehistoric American Indian component of undetermined age and 17th and 18th century historic-period components. Most human activity at the site occurred during the historic period, from the early 17th through early 18th centuries. A boundary ditch probably dates to a later period. Notably, the site contains intact early 17th century cultural features that may hold information about initial English settlement beyond New Towne. The Travis family bought the property in 1653 and kept it until 1831.

- Site 44JC898 contains an ephemeral and undatable prehistoric American Indian component. Historic-period remains at the site suggest that the site was occupied in the late 18th and early 19th centuries.
- Site 44JC899 is a multi-component site, with prehistoric American Indian and historic-period features. Concentrations of prehistoric artifacts suggest an Archaic period occupation. Historic-period artifacts largely consist of architectural debris and may be associated with 19th or 20th century occupation. A berm on-site that abuts the marsh corresponds to one on the opposite side of the marsh. Both berms may have connected a wooden footbridge, noted on a 1937 NPS map as a “manway,” or trail used for patrolling the Island. Other surface features may be the remains of boundary ditches, plow furrows, or roads.
- Site 44JC900 has sparse prehistoric artifacts across the site, indicating only sporadic use. Historic-period features are extensive, indicating intensive site use from the 17th through the early 19th centuries. The two most notable historic-period features are the Travis family mansion house and cemetery. Artifacts suggest site occupation from 1650 to 1780. Also identified are the remains of an earthfast structure, perhaps the mid-17th century dwelling of Edward Travis I. Site 44JC900, the Travis domestic complex and graveyard, ranks as one of the most important archaeological sites on Jamestown Island.
- Site 44JC901 is a historic-period site dating to the colonial period or later. The site, marked by an abundance of handmade bricks, may have been used strictly for industrial purposes, as it lacks any evidence of domestic occupation. Other features include the remnants of an old field system and a brick-lined well. The site requires further study. It became part of the Travis plantation in 1653 and remained in the Travis family until 1831.
- Site 44JC902 contains evidence of ephemeral American Indian activity and a historic component possibly dating to the colonial era. The site lies on the tract once owned and occupied by the Travis family.
- Site 44JC905 is a multi-component site, containing a Late Woodland period component and several historic-period components ranging from the 18th through 20th centuries. Prehistoric artifacts from the site reveal that Late Woodland peoples harvested resources from the nearby marsh. The site’s historic-period features include an 18th century dwelling, part of a probable 18th century road, and a portion of a Civil War-era road. The heaviest brick concentration, noted on both sides of the NPS Loop Drive, is the site center. It is unclear how many domestic loci are present at the site, although one appears to date between 1720 and 1762 and a second dates to after 1769. These architectural rubble clusters may be the remains of slave or overseers’ quarters belonging to the Travis plantation. Artifacts suggest that a 17th century component might also be present.
- Site 44JC906 is a large, multi-component historic-period site, containing deposits ranging from the 17th to the 20th centuries. Documents indicate that the site is located on tracts initially patented by “Ancient Planters.” Before 1619 the site became part of the Travis plantation and may have been a domestic site occupied by Travis plantation slaves, overseers, or tenants.
- Site 44JC907 is a multi-component site, containing both prehistoric American Indian and historic-period materials. Prehistoric American Indian materials are generally

sparse but indicate a Late Woodland encampment. Certain prehistoric features, however, may predate the Woodland camp, possibly dating to the Archaic period. The site's most prominent historic-period feature is a Civil War fort, known as the Square Redoubt. Historic-period artifacts occur both in and beyond the fort and date from the 17th through the 19th centuries. Eighteenth century materials may indicate an outlying tenant farmer or overseer compound related to the Travis family plantation. The Square Redoubt, built by the Confederates in 1861, was a component of Jamestown Island's defense system. A Civil War road has also been identified there.

- Site 44JC908 is a multi-component site containing an American Indian component from the Late Woodland (possibly Protohistoric) period and historic-period components from the 17th through early 18th centuries. Earthen enclosures, large boundary ditches, and berms separate marginal land from former agricultural fields. The historic-period artifact assemblage suggests a modest domestic site inhabited during the 17th and early 18th centuries. The site is an important example of an interior 17th century farmstead. The site's possible Protohistoric component is also of considerable importance, because it may hold information about Powhatan lifeways on the eve of English colonization. Site 44JC908 is one of the most thoroughly documented early-historic sites on Jamestown Island. Before February 1619, 44JC908 and its surroundings were owned and occupied by an "Ancient Planter" who immigrated to Virginia in 1611. In 1620, when the 12-acre homestead was sold, reference was made to a dwelling and another little house that were parts of the domestic compound.
- Site 44JC917 contains a prehistoric American Indian component of undetermined age, plus numerous historic-period features. These well-preserved surface features possibly include colonial-era roads, a causeway, and enclosures. The site lies atop a ridge that may have functioned as a causeway linking New Towne with the Kingsmill tract. A 1664 plat of the site vicinity depicts two bridges crossing a marshy area of Pitch and Tar Swamp. Two earthen enclosures have been identified that may have been intended to exclude or enclose livestock. Although little is known about the early ownership of the acreage encompassing 44JC917, it is clear that by October 1661 the area belonged to a merchant.
- Site 44JC921 consists of a prehistoric American Indian component dating to either the Middle Woodland or Late Woodland period. The site also contains a historic-period component dating to either the 18th or 19th century. A ditch and berm feature, possibly marking an early-historic fence line, runs lengthwise along the ridge through the site, separating high ground from low. This berm follows the zigzag course of the presumed fence line and may contain rarely preserved fencing landforms made by Jamestown Island colonists. Site 44JC921 may also reveal insights into Woodland period domestic life.
- Site 44JC922 contains an undated prehistoric component representing only sporadic American Indian use of the area. The site also contains a 17th or 18th century artifact scatter that may indicate a domestic occupation or may be associated with another nearby domestic site. Historic-period features include a colonial-era brick kiln and clay borrow pit, a system of ditches and berms, a Civil War-era road, and the NPS Loop Drive. Re-deposited earth and debris,

dumped across the site during the 20th century by either the Barney family or the Civilian Conservation Corps, obscure the underlying cultural deposits. During the first quarter of the 17th century, John Jefferson, a gunsmith and former servant of the Virginia Company, occupied this area.

- Site 44JC925 contains a small number of Late Woodland period artifacts. Historic period artifacts range in date from the 17th through the 20th centuries. Architectural materials account for almost 80% of the historic-period artifacts. A roadbed passes through the site and continues across Pitch and Tar Swamp, connecting with a causeway. Several ditch and berm features are evident. Twentieth century road construction and farming activity have impacted the western periphery of the site. Although little is known about the site's early 17th century landownership, by 1656 the site clearly belonged to John Phipps. Sometime between 1739 and 1822, this site fell within the property boundaries of the Ambler plantation. Quite likely, the site's architectural debris is the vestige of slave, servant, or tenant quarters associated with one or more of these earlier landowners.
- Site 44JC926, a multi-component site, contains a small concentration of American Indian material dating to the Late Woodland/ Protohistoric period. In addition, the site contains several historic-period features, including a well-preserved earthen enclosure, an earthen boundary ditch, and a 17th or 18th century locus just west of the boundary ditch. Further archaeological evidence of colonial occupation lies west of the Loop Drive. The boundary ditch may coincide with the 17th century property line of Dr. John Pott, the Virginia colony's physician general. Architectural debris dominates the historic-period artifact assemblage: brick

fragments, window glass fragments, and wrought nails. From 1739 to 1822, all of site 44JC926 lay within the boundaries of the Ambler plantation. The site's historic-period structures are possibly slave, servant, or tenant houses associated with one or more of the former landholders. Materials indicating some 19th and 20th century activities include two relatively modern trash dumps that may have been left by CCC workers.

Glasshouse Point

The following archaeological sites have been identified at Glasshouse Point:

- Site 44JC106 is a multi-component site, containing both prehistoric American Indian and historic-period components. The prehistoric components date to the Late Archaic, Middle Woodland, and Late Woodland periods. Historic-period components, dating to the 17th century and perhaps to the 18th century, indicate domestic and military occupations. Recent investigations identified a mid-17th century dwelling house, which may be Glasshouse Point's "old chimney ruin" (McCartney 2000a), fortified by Nathaniel Bacon's rebels in 1676. Further evidence of Bacon's likely activities at the site is an earthen berm that may have been a defensive earthwork constructed by his men during their brief seizure of Jamestown Island. Given this possibility, the site holds high potential for revealing new information about Bacon's Rebellion.
- Site 44JC986 is a multi-component site, containing both prehistoric American Indian and historic-period components. The site is associated with the Late Woodland period. Within this site lie the remains of the Jamestown settlers' original Glasshouse. This Glasshouse (Structures 107, 108A, 108B, and 109) was located and partially uncovered by property owner Jesse Dimmick in the 1920s.

In 1948, NPS archaeologist J.C. Harrington excavated and recorded the site. The Glasshouse is crucial to a greater understanding of industrial experimentation at early Jamestown. Another colonial-era feature evident at 44JC986 is the Greate Road, which once connected Jamestown Island to the mainland.

- Site 44JC1019 is a multi-component site, containing both prehistoric American Indian and historic-period resources. Prehistoric artifacts indicate American Indian activity during the Late Archaic, Early Woodland, Middle Woodland, and Late Woodland periods. Historic-period materials at the site indicate occupation during the 18th, 19th, and 20th centuries.

Neck of Land

The following sites have been identified at Neck of Land:

- Site 44JC1047 is a historic period domestic site, occupied during the late 17th and early 18th centuries. Historical records suggest that the Page family owned the property. A brick foundation of one structure and associated artifacts suggest a domestic occupation by people of low to median economic status. The presence of colonoware (low-fired, hand-coiled earthenware produced in the English Western Hemisphere colonies, most probably by African slaves) suggests that tenant farmers or slaves inhabited the site. The site holds high potential for revealing new information about marginal economic and ethnic groups in colonial Virginia society.
- Site 44JC1048 is also a historic-period domestic site, occupied principally between the late 18th and early 19th centuries. There is evidence of a second, smaller, 20th century occupation. Recent investigations identified a possible smokehouse, fence posts, and slot trenches. Further archaeological

investigations at 44JC1048 are warranted to better ascertain the site's functions.

- Site 44JC1049 is a prehistoric American Indian site of unknown age situated across a terrace overlooking Powhatan Creek.

3.3.1.4 Historic Buildings, Structures, and Cultural Landscapes

The APVA and NPS properties jointly contain 19 buildings and other structures that interpret Jamestown's history and support visitor and staff activities. Buildings include commemorative buildings, outbuildings, and buildings constructed to maintain or manage the sites, while structures include monuments, ruins, berms, brick foundations, memorials, statues, roads, gravestones, fences, earthworks, bridges, and other human-made elements. Both buildings and structures become key components to the cultural landscape. An inventory of all NPS-owned historic structures, known as the *List of Classified Structures* (LCS), has been completed for Colonial National Historical Park. In addition, there is draft documentation for the National Register of Historic Places on which both the NPS and APVA properties are listed. The draft includes all of Jamestown Island and Glasshouse Point but not Neck of Land.

The description of the existing cultural landscape features for the affected environment has been adapted from selected data from the ongoing *Cultural Landscape Report (CLR) for Jamestown Island* (OCULUS 2002). Resources include the multi-volume *Jamestown Archeological Assessment, 1992-1996*, the completed *Jamestown Cultural Landscape Inventory, Level One* (NPS 2000c), the *Cultural Landscape Report for Colonial Parkway* (Landscapes 1997), and preliminary findings from fieldwork. In addition, research of APVA and Colonial NHP building files found historical maps and plans. Contributing and noncontributing features have been identified for all landscape features and can be used in describing the existing conditions and impacts

of the action alternatives. The completed CLR for the Colonial Parkway (Landscapes 1997) also defines contributing and noncontributing features of the Parkway and can be used in describing the existing conditions and impacts of the action alternatives. Determined a unique cultural resource, National Register documentation (approved July 9, 2001) has also been completed for the Colonial Parkway under a separate document. It is for this reason that the Colonial Parkway is will be described as an additional distinct area in this section.

Existing Landscape Types

Three historic landscapes can be clearly observed as a result of the field and document research for the development of the *Jamestown Island CLR*. The individual features that reflect their specific time period contribute to the definition of these landscapes. They are directly linked to natural systems and major human development activities on and surrounding Jamestown Island. All retain a high level of historical integrity.

The landscape that most accurately reflects the 17th century historic scene is the existing natural environment on the island and its defining bodies of water. Marshes, rivers, and dense woodland sustained the indigenous people and greeted members of the Virginia Company upon their arrival. In addition, the Travis family cemetery, historic boundary ditches, and roadways are found throughout the island.

The area defined by the APVA property defines the second historic landscape. Features reflect the period of memorialization of Jamestown Island between the end of the 19th century and the first half of the 20th century. The location of remaining landscape features and overall design of the site still reflect the original intention for the site to be a park -like commemorative landscape.

The third landscape is the mid 20th century modern interpretive landscape built by the NPS and includes Glasshouse Point, the Colonial Parkway,

New Towne, and Island Loop Drive. This represents a large-scale designed landscape that was initiated in the 1940's and completed in 1957 as part of the Mission 66 park development period. Interpretation was incorporated into New Towne, but its physical impact did not detract from its commemorative landscape.

There are landscape features and historic structures that are from the 18th to the mid 19th centuries that exist throughout these sites. While they are contributing features in understanding the history of the Island overall, they do not emerge as key elements that define a larger landscape. These would include civil war earthworks, orchard remnants, and architectural ruins like the Ambler House.

In order to understand these larger landscapes and their relationship to their sub area components, buildings, structures and landscape features are organized below into five geographical areas: Jamestown Island (including the Loop Drive), Old Towne, New Towne, Glasshouse Point, Neck of Land, and the Colonial Parkway. Figures 3-1, 3-2, and 3-3 depict the locations of items discussed below.

Jamestown Island

Many natural and topographic features are integral to the Island landscape. Natural resources such as soils, vegetation, and hydrologic systems shaped the Island over time.³ Topographic features range from flat, low-lying wetlands to broad terraces lying just above current sea level. The rising, leveling, and receding nature of this system are integral to understanding this place throughout time and space. Use and manipulation of its land, water, and resources started with the native peoples and continues with its present use as a national park and historic site.

³ Descriptions of these resources are detailed in their respective sections.

The most significant effect on the Island's cultural landscape today is shoreline erosion. The severity of erosion increased beginning with the historic period, especially since the 19th century with the advent of motorized watercraft. Erosion has negatively impacted an estimated 40% of extant archaeological sites along the shoreline.

Jamestown Island has a variety of naturally occurring and planted vegetation. Biotic communities are described in detail in the "Vegetation" and "Wetlands" sections of this document. The manipulation of vegetation on the entire Island over time removed original forest cover, thus the current mixed deciduous and pine woodlands are successional communities. From the 17th to the early 20th century, the Island had an open character, with most of the arable land under cultivation. Pine woodlands, the first to establish after cultivation was abandoned, now cover 22% of the Island. Mixed deciduous woods, comprising approximately 18% of the Island's vegetative cover, are part of the larger oak/hickory climax forest that characterizes much of Virginia's Coastal Plain. Brackish wetlands constitute the rest of the Island vegetation (Johnson et al. 2000).

The Mission 66-designed Loop Drive begins at the northeastern edge of the visitor parking lot. The Drive, a series of two interconnecting loops, heads southeast from the Parkway terminus and allows visitor access to other, less developed, yet interpreted areas of the Island. The one-way drive with its planked bridges winds through wooded landscapes, opening onto views of marshes and their creeks. At Black Point a dirt path leads to the confluence of the James River and Back River. Eleven pull-offs highlight interpretive panels related to the area.

Historic landscape features, such as remnant ditches and Civil War earthworks, are found in the outer parts of the Island. Historically, ditches marked property boundaries or were used to drain land. Three Civil War earthworks were part of a system to protect the James and Back Rivers from Union gunboats.

The only remaining aboveground feature associated with the Travis family occupancy is the Travis graveyard, located on land that was part of the Travis plantation during the 17th, 18th, and early 19th centuries. Only three slab-topped tombs remain. These structures are summarized in Table 3-2. The table also includes whether they are features that contribute to the cultural landscape as historic features or structures.

Table 3-2: Summary of Landscape Features – Jamestown Island

| Circulation, Structures, & Objects | | | Small-Scale Features | | |
|------------------------------------|---|-----------------------|---|----------------|-----------------------|
| Item | Date Installed | Contributing (Yes/No) | Item | Date Installed | Contributing (Yes/No) |
| Travis Graveyard | 17 th – 19 th century | Yes | Interpretive Waysides with Copies of Original Sidney King Paintings | 1990s | No |
| Remnant Ditches | 17 th – 19 th century | Yes | Park Signs | Current | No |
| Black Point Trail | Mid-20 th century | Yes | Traffic Signs | Current | No |
| Sand Battery | 1861 | Yes | Interpretive Text Signs | 1956 | Yes |
| Square Redoubt | 1861 | Yes | | | |
| Point of Island Battery | 1861 | Yes | | | |
| Loop Drive | 1957 | Yes | | | |

Old Towne

The ebb and flow of the James River characterizes the Old Towne site. The massive, early 20th century seawall still retains the shoreline. This area is composed mostly of a flat terrace permeated by marsh and wetlands with an open shallow valley in the central area of the landscape. The Pitch and Tar Swamp delineates the northern edge of the valley. Mowing and ditching limits the wetland in the vale to grassland. High tides generated by storms often flood this area (Johnson et al. 2000). A large borrow pit, used to construct the seawall, is located near the end of the Colonial Parkway at the visitor parking area.

The vegetation identified in Old Towne is varied and represents native and exotic species, both naturally occurring and managed. The plant associations and communities evidenced during field investigations for the Jamestown CLR (OCULUS 2002) include wetlands associated with Pitch and Tar Swamp, mown-grass lawns, successional woodlands, ornamental planting beds, and specimen tree and shrub plantings associated with the commemorative landscape.

Of particular note are the cedars planted in and around the Confederate Fort (Fort Pocahontas), particularly in the moat area. A live oak commemorates the Magna Carta south of the timber memorial cross and west of the valley. Further information on the date and purpose of plantings will be available once the CLR is complete.

The general spatial organization of Old Towne still reflects the Warren Manning master plan concept of an open, park-like setting, ordered by the various paths. Shell and gravel paths follow existing contours, weaving in and out of existing features in an east-west manner. Visitors encounter commemorative plantings, the James River, buildings, memorial structures, and open archaeological excavations as they tour the site.

Vehicular access to the site is restricted to NPS/APVA traffic along service roads. A gravel

employee parking lot for 10-15 vehicles is located directly behind the Jamestown Rediscovery™ Center near the mule barn and service buildings. The parking lot is accessed by a service road leading from the Colonial Parkway as it enters the Visitor Center parking lot at the Old Towne site. Concrete gates with decorative ironwork mark the entrance of the road at the APVA property line.

This service road continues south past the parking lots, running through Old Towne between the valley and the Confederate Fort (Fort Pocahontas). The road continues to the western side of the NPS/APVA Visitor Center, and ends in a small, gravel parking area on the north side of the building. An informal vehicular road runs from this road towards the Dale House.

Beginning in the late 19th century and continuing throughout the 20th century, buildings, structures, and objects were erected to commemorate this significant site and educate and provide service to visitors. A large number of buildings, structures, and objects characterize Old Towne.

The historic buildings on APVA property include the original brick Jamestown Church Tower ruin, the reconstructed Memorial Church, the Yeardley House (Jamestown Rediscovery™ Center), the Dale House, and the Godspeed Cottage.

The only 17th century aboveground structure on the Island, the Church Tower, is attached to the brick Memorial Church, which was a gift of the National Society of the Colonial Dames of America. The design of this 1907 church was patterned after an early Episcopal church in Smithfield. It provides both active services and interpretation programs to visitors. A masonry cemetery wall encloses a burial ground to the east of the church. The complex sits on a high point on the river shoreline. Sweeping views of the James River and Surry County are visible from the church's southern access.

A gift of the National Society of the Daughters of the American Revolution in 1907, the Yeardley

House (Jamestown Rediscovery™ Center) is built in the Colonial Revival style. This 1 ½ story structure has been altered by additions to the building, resulting in an H-shaped plan. The building entrance includes a boxwood-enclosed geometric parterre garden with brick-edged gravel walks.

Several frame buildings define the APVA service spaces behind the Jamestown Rediscovery Center. This cluster of buildings includes the mule barn and a service shed. The mule barn is the oldest structure, a remnant of the 19th and early 20th century agricultural activities on the Island. The Jamestown Rediscovery Center and the associated service buildings are located on a small ridge adjacent to the Pitch and Tar Swamp.

On the same small ridge is the Colonial Revival Godspeed Cottage, built in 1933 and moved in 1939 from its original site. Mature hardwoods surround the house, and it is used as a private residence for APVA staff.

The Dale House, also a Colonial Revival brick building, is located next to the seawall path. The building has a south-facing porch that provides shade and sweeping views of the James River. The building houses a conservation lab and an exhibition on the archaeology of Old Towne.

Southeast of the Jamestown Church is a modern tensile fabric structure. Resembling a large onion-dome, this structure protects an open archaeological excavation. The structure was erected in the late 1990s by the APVA through funds provided by James City County.

Many commemorative statues and memorial structures are found throughout the site. These include the John Smith statue; the Robert Hunt Shrine; the timber Memorial Cross; the Pocahontas statue; the iron and brick Memorial Gates; a rough-hewn Commemorative Granite Cross; the short, granite obelisk; the Neo-Classical style

Commemorate Granite Bench; the wooden commemorative bench; the cast bronze water trough; and, the masonry marker and live oak, which commemorate the Magna Carta.

The 1861 Civil War Confederate earthwork, Fort Pocahontas, still exists although its south wall has eroded into the James River. A pedestrian trail provides east/west access into the earthwork. Two masonry structures concealing utilities are located along the northern edge of the earthwork.

Small-scale features observed within Old Towne are generally associated with interpretation, ongoing archaeological excavation, visitor services, APVA infrastructure, and circulation. Interpretive features are found primarily near archaeological sites. These include wood-framed wayside panels. A series of split-log palisade fence lines and concrete block markers are the newest interpretive devices. The logs and markers represent the original 1607 revealed fortification alignment found during archaeological excavations. In addition a cast iron fence-line and gate and a prefabricated temporary pale fence delineate the foundation edge of the Ludwell Statehouse Group. Other small-scale features found throughout Old Towne include a sundial, two Victorian-style benches, drainage grates, two masonry headwalls, rope and iron fencing, and pale fencing surrounding a private garden north of the Godspeed Cottage.

Table 3-3 summarizes the buildings, structures and objects, as well as the small-scale features, located in the landscape of Old Towne. The table also includes whether they are features that contribute to the cultural landscape as historic features or structures.

Table 3-3: Summary of Landscape Features – Olde Towne

| Buildings, Structures, Objects & Spatial Organization | | | Small-Scale Features and Vegetation | | |
|---|----------------|-----------------------|---|--|-----------------------|
| Item | Date Installed | Contributing (Yes/No) | Item | Date Installed | Contributing (Yes/No) |
| Church Tower Ruin | 1639 | Yes | Low Brick Graveyard Wall | 18 th century | Yes |
| Churchyard | 1639 | Yes | Taller Graveyard Masonry Wall | 18 th century | Yes |
| Fort Pocahontas (Confederate) | 1861 | Yes | Churchyard Iron Gate and Fence Line | Late 19 th - early 20 th century | Yes |
| Mule Barn and addition | 1935/37 | Yes | Gravestones in Jamestown Churchyard | 17 th – 20 th century | Yes |
| Ludwell Statehouse Ruin Site with Foundations | 1904 | Yes | Commemorative Granite Cross | 1898 | Yes |
| Seawall | 1901-07 | Yes | Memorial Concrete and Iron Gates | 1907 | Yes |
| Memorial Church | 1907 | Yes | Bronze Water Trough | 1907 | Yes |
| | | | Brick and Iron Memorial Gates | 1907/relocated 1958 | Yes |
| Dale House | 1907 | Yes | First Assembly Monument | 1907 | Yes |
| Yardley House | 1907 | Yes | Memorial Fountain Trough | 1907 | Yes |
| John Smith Statue | 1909 | Yes | Pocahontas Statue | 1922 | Yes |
| Robert Hunt Shrine | 1909 | Yes | Granite Obelisk | 1907 | Yes |
| Godspeed Cottage | 1933 | Yes | Magna Carta Masonry Marker | not determined | Yes |
| Temporary Tensile Structure | 1999 | No | Memorial Granite Bench | 1928 | Yes |
| Service Shed | post 1980 | No | Reconstructed Masonry Well | 1906 | Yes |
| Greate Road Trace | Ca. 1607 | Yes | Timber Memorial Cross | 1957 | Yes |
| The Vale and Road | 1914 | Yes | Commemorative Wooden Bench | 20 th century | Not determined |
| APVA Access Road | 1861-1906 | Yes | Interpretive Palisade and Blocks | 2001 | No |
| APVA Service area corridor | 1906 | Yes | Ludwell Statehouse Group Fencing and Markings | 1925 | Yes |
| Yardley House Parking Lot | 1999 | No | | | |
| Yardley House Garden and walks | 1910 | Yes | Archaeological Excavations | Current | No |
| Seawall | 1900-1904 | Yes | Sundial | 1907-08 | Yes |
| Seawall Walk | 1907 | Yes | Yardley Garden Boxwoods | 1964 | No |
| Vale and its Defining Walkways | 1910 | Yes | Specimen Tree Plantings and Turf Areas | 1890's, early 20 th century | Yes |
| | | | Retained Tree Areas at Fort and Service Area | 1890's, early 20 th century | |
| | | | Pale Fencing | 20 th century | No |

New Towne

Located on a broad, flat terrace, New Towne is the area used by the colonists for their expanded Townsite. The Pitch and Tar Swamp, the James River, and Orchard Run delineate it. Over time, the river has shaped the southern edge of this area through erosion. To combat erosion, riprap was installed in the 1930s. Despite this barrier, sinkholes and erosion continue to undercut the banks.

New Towne is defined on the southeast by a pine/oak forest and on the north by the associated wetland vegetation of the Pitch and Tar Swamp. Vegetation in the New Towne area is planted and intensively managed. Mown lawns are interspersed with specimen plantings such as crape myrtle, dogwood, cherry, and white mulberry. Mature trees in this area include American elm, pine, walnut, red oak, white oak, sycamore, sweet gum, cedar, white mulberry, catalpa, and pecan.

A line of cedar trees, planted to enhance the reconstructed interpretive features, stands near a bed of irises and fig trees adjacent to the Highway Close to the River. At the southeastern edge of the developed area is a stand of pecan trees in a linear arrangement. Their size indicates they are a remnant of the pecan orchard planted during the Barney period of occupation, at the turn of the 20th century.

The Mission 66/Bicentennial Visitor Center and Townsite are accessible from the visitor parking lot by a wide, paved pedestrian path leading to a wooden footbridge over the Pitch and Tar Swamp. After the bridge, a concrete ramp leads to the principal entrance of the Visitor Center. Visitors can take this path or enter New Towne by 3-foot paths beginning at the base of the ramp.

Visitors and employees exiting the Visitor Center through the museum store enter a paved amphitheater that adjoins the paved plaza surrounding the Tercentennial Monument. The plantings, raised masonry walls, and exposed

aggregate concrete panels define and enclose this plaza. A ring of Bradford pears and circular arrangement of pavers guide visitors to walk around the obelisk. This is the highest point in the developed area; views out to both New and Old Towne are panoramic.

New Towne provides many types of views and vistas. To the south are open panoramas of the James River and Surry County, and to the north, Old Towne and the Pitch and Tar Swamp. Finally, strategic views of the Tercentennial Monument can be enjoyed from various locations throughout New Towne.

An interpretive trail of crushed shell leads from the Visitor Center and splits into two directions, going west to the original fort site and the Jamestown church and east to the New Towne area. Reconstructed features and specimen plantings express 17th century landforms in a 20th century interpretive landscape. Reconstructed foundation markers, ditches, and fence lines delineate property lines and urban lots discovered during archaeological excavations. The interpreted Townsite is organized along a grid system of paths. Seventeenth century Back Streete and the Highway Close to the River, both running east to west, are integral to the interpretive path system.

Within New Towne, buildings, structures, and objects were constructed and erected throughout the second half of the 20th century to interpret this significant landscape and to educate and service incoming visitors. The interpretation of Jamestown as it existed from 1607 to 1699 is the primary focus. In the landscape, visitors will find the footbridge restroom, the Visitor Center, the outdoor amphitheater, the Tercentennial Monument, and the interpretive historic Townsite. To a considerable extent, the configuration of the numerous reconstructed boundary ditches, surviving ruins (Ambler House), reconstructed brick foundations, period fences, benches, trash receptacles, interpretive signage, and audio boxes is intended to educate visitors and enhance their experience of the site.

The comfort station (footbridge restrooms) southeast of the visitor parking lot was built for the Bicentennial of the American Revolution and is not considered historic. The Visitor Center, an example of an early Mission 66 effort, does not contribute to the national significance of Jamestown. It is not a prototypical structure that influenced the evolution of the visitor center as a building type. The brick rectangular building was substantially altered in 1974-76 with the addition of a large triangular lobby, and an exhibit and sales area. The Visitor Center is a two-story building located partially on the highest point in the developed area.

The historic Jamestown Tercentennial Monument is built of granite and is 103 feet tall; it dominates the landscape of New Towne. Erected in 1907 to commemorate the landing of the first colonists and the founding of the first permanent English colony, it was transferred to National Park Service ownership in 1931. It consists of a three-part step base and an inscribed obelisk. The step base contains recessed panels, each framed by two small panels bearing a lion's head. The steps to the base were buried during the 1956 construction of the Visitor Center to form a plaza. A change in paving and the addition of 14 Bradford pears encircling the base came during the improvements for the Bicentennial of the American Revolution.

The remains of the historic Ambler House, which documentary and architectural evidence suggests was built during the mid-1750s, tower over the central landscape in New Towne. The ruins have been somewhat stabilized with tie rods and copper coping. However, the building has been negatively impacted by structural deterioration from weather and erosion.

New Towne contains many interpretive landscape features that represent original and reconstructed circulation and organizational patterns. They are located along a series of paths connected by plank footbridges. A significant, yet masked, circulation feature within New Towne is the Highway Close to the River, which connected to the Greate Road.

Based on findings from excavations conducted in the 1930s and 1950s, reconstructed ditches delineate property lines of 17th century Jamestown residents. They define the grid of New Towne. Within the boundaries formed by these ditches are several reconstructed brick foundation markings. The locations of these markings are also based on archaeological excavations. Doorways are represented by open voids within the masonry, allowing visitors access while clearly marking the presumed principal facade of these interpreted sites. Hearth foundation markings were also built to aid interpretation. A demonstration stone hearth, located north of Back Streete near the Pitch and Tar Swamp, and a reconstructed interpretive masonry well near the Highway Close to the River are two additional interpretive features.

Three styles of interpretive signage further depict 17th century life in New Towne. Illustrated panels are located near many of the interpretive foundations. Large-font text panels and large panels illustrating Island maps and directional information are adjacent to the Townsite.

Throughout the open interpreted area, a number of masonry features combine interpretive audio boxes with low benches. Built as a single entity in 1957, these features exhibit the horizontal lines and cantilevered sections of the early modern period.

Many styles of period fencing are located around interpreted foundations and site groupings. These include the post-and-rail fences with varying details; short palisade fences; a slanted post-and-rail or Swede fence; the remains of a low, wattle fence; and, the worm fence.

Finally, a number of small-scale features within the landscape contribute to visitor comfort. Moveable and immovable wooden seats, water fountains, and trash containers are found throughout New Towne. Constructed stormwater and public water features such as drainage grates and riprap are also visible.

Table 3-4 summarizes the buildings, structures, and objects, as well as small-scale features found in the New Towne landscape. The table also includes whether they are features that contribute to the cultural landscape as historic features or structures.

Glasshouse Point

Located between Powhatan Creek, Sandy Bay, and the James River, Glasshouse Point is characterized by a flat, low-lying terrace sloping toward the James River. A sandy stretch of land on its western edge provides safe access for visitors to the James River. Here, panoramic views of the river, Surry County, and the Jamestown-Scotland Ferry can be seen. Otherwise, foliage obscures viewsheds to the Colonial Parkway and other parts of the Island.

At Glasshouse Point, the land bridge to the Island eroded away in the late 18th century and was not rejoined until the mid-20th century when the NPS built the isthmus. This action changed the biotic and landscape character of the confluence of the Back River and the James River, creating Sandy Bay.

Glasshouse Point contains many invasive exotic plants including wisteria, kudzu, and bamboo. Natural growth is limited to lowland pine/oak forest including a nontidal-forested wetland and tidal or emergent wetland/marsh.

Constructed in 1957 during the Mission 66 period, the Glasshouse area is organized around a number of interpreted structures relating to the discovery of an early glassmaking site. Access is from the Colonial Parkway just inside the entrance gates. Traffic moves along a one-way road that loops around a central, vegetated median. Parking for visitor and staff is organized around the outer and inner edges of this loop. A comfort station is located in the center of the median.

Pedestrian trails located off the parking area lead to the interpretive area. An interpretive loop trail passes by interpretive signs, the existing Greate Road trace (a significant cultural landscape feature), the original glasshouse ruins, and the modern interpretive exhibit. Two employee paths radiate from this trail, leading to a modern utility structure and to the Harrington House, respectively. A third employee path connects the visitor parking area to the ranger station. A service road, beginning southeast of the parking lot, terminates in a service parking area adjacent to the modern Glasshouse.

A number of buildings and structures were erected for visitors and NPS staff during the Mission 66 period. They include the comfort station, the Harrington House, and the modern Glasshouse. A glasshouse ruins exhibition building was also constructed during the Bicentennial of the American Revolution. The modern Glasshouse building was architecturally modified and rebuilt during the 1970s after a fire totally destroyed the original 1957 building. Additionally, the comfort station was remodeled in 2000. A number of modern structures housing utilities are also located in the Glasshouse Point developed area, including a small utility station, a masonry structure, and a gable-roofed wattle and daub structure. Utilities not sheltered by structures are clustered around modern structures and an overhead utility line passes through part of the Glasshouse area.

Small-scale features in the Glasshouse Point area, such as interpretive waysides, fences, signs, and parking-related structures, have interpretive value and enhance the visitor experience. Table 3-5 summarizes these small-scale features, as well as the buildings and other structures in the landscape at Glasshouse Point. The table also includes whether they are features that contribute to the cultural landscape as historic features or structures.

Table 3-4: Summary of Landscape Features – New Towne

| Buildings, Structures, Objects, Spatial Organization & Vegetation | | | Small-Scale Features | | |
|---|---|-----------------------|--|---------------------------------------|-----------------------|
| Item | Date Installed | Contributing (Yes/No) | Item | Date Installed | Contributing (Yes/No) |
| Ambler House | 18 th – 19 th century | Yes | Box-wire Fencing | Early to mid-20 th century | Yes |
| Tercentennial Monument | 1907 | Yes | | | |
| Mission 66 – Visitor Center | 1957/74 addition | No | Moveable Wood Benches | Current | No |
| Mission 66 – Footbridge and Corridor | 1956 | Yes | Brick Water Fountain | 1957 | Yes |
| Visitor Entrance Ramp and Terrace | 1974 | No | Water Fountain | 1976 | No |
| Utility Sheds | Current | No | Cast Iron Grates | Not determined | Not determined |
| Mission 66 - Plank Bridges | 1957 | No | Demonstration Stone Hearth | Not determined | Not determined |
| Highway Close to the River | Ca. 1620s/1956 overlay | Yes | Barrel | Not determined | No |
| Back Streete | Ca. 1620s/1956 overlay | Yes | Mission 66 Interpretive Signage with Sidney King paintings | 1994 | No |
| Greate Road Trace | Ca. 1607 | Yes | Flagpole | Not determined | Not determined |
| Tercentennial Monument Plaza | 1974 | No | Mission 66 Interpretive Ditches (Reconstructed 17 th Century) | 1956 | Yes |
| Gravel Service Road and Employee Parking | 1956 | Yes | Mission 66 Interpretive Foundations | 1956 | Yes |
| Interpretive paths | 1956 | Yes | Masonry Well Surround | 1956 | Yes |
| Amphitheatre Area | 1974 | No | Text-only Panels | 1956 | Yes |
| Visitor Center Area Plantings | 1970;s | No | Directional Signage | 1957 | Yes |
| Town site Exhibit Specimen Trees and Turf | Early 1930's, 1956 | Yes | Post and Rail Fence | Not determined | No |
| Pecan Orchard | Ca. 1900 | Yes | Original V-shaped Post and Rail Fence | 1956 | Yes |
| Rip rap Seawall | 1935 | Yes | Original Palisade Fence | 1956 | Yes |
| | | | Original Pale Fence | 1956 | Yes |
| | | | Original Hewn Horizontal Logs | 1956 | Yes |
| | | | Original Swede Fence | 1956 | Yes |
| | | | Worm Fencing | Not Determined | No |
| | | | Audio Stations and Low Benches | 1955 | Yes |

Table 3-5: Summary of Landscape Features – Glasshouse Point

| Buildings, Structures, Objects, Spatial Organization & Vegetation | | | Small-Scale Features | | |
|---|----------------------|-----------------------|-----------------------|-------------------------|---------------------------|
| Item | Date Installed | Contributing (Yes/No) | Item | Date installed | Contributing (Yes/No) |
| Mission 66 Comfort Station | 1956/2000 remodeled) | Yes | Chain Link Fence | Not Determined | Not Determined |
| Glasshouse Ruins Exhibition Building Shelter | 1956 / | Yes | Post and Rail Fences | Not Determined | Not Determined |
| Glasshouse Ruins Exhibition Building Addition | 1975 | No | Concrete Curbing | 1957/2000 modifications | Yes for original material |
| Modern Demonstration Glasshouse | 1976 (rebuilt) | No | | | |
| Harrington House | 1956 | Yes | Directional Signage | Current | No |
| Utility Station at Entrance Station | Not Determined | No | Informational Signage | Current | No |
| Utility Station at Glasshouse | Not Determined | No | Display Cases | Not Determined | Not Determined |
| Utility Area at Harrington House | Not Determined | No | Interpretive Signs | 1956 | Yes |
| Harrington House Path | 1956 | Yes | Interpretive Signs | Current | No |
| Greate Road Trace | Ca. 1607 | Yes | Kiosk | Not Determined | No |
| Interpretive Paths to Exhibits and Glasshouse | 1956 | Yes | Benches | Not Determined | Not Determined |
| Ranger Station Path | Not determined | Not Determined | | | |
| Loop Drive and Parking Area | 1956 | Yes | Riprap | 1949-56 | Yes |
| Specimen Trees and Turf | 1956 | Yes | | | |

Neck of Land

Neck of Land is a flat terrace supporting a variety of natural species and abundant wildlife. The area has been shaped by the ebb and flow of Sandy Bay, Back River, and their associated tributaries. Two peninsulas, extending south and southwest respectively, extend from the central portion of the area. Elevations increase toward these peninsulas and then level into raised terraces that overlook the river and the marsh.

A large portion of the area is spatially organized around its natural systems and features. Details of the ecological community are discussed in the “Wetlands” and “Vegetation” sections of this document. Dense vegetation limits the views

and vistas from the Neck of Land. However, as the natural landscape changes from dense forest to marshland toward the southern terminus of the abandoned road, part of the Colonial Parkway can be seen looking north. At the southern edge of the forest the landscape opens to the marsh with panoramic views overlooking Back River and Sandy Bay.

The Old Route 31 road trace bisects Neck of Land, running south from the Colonial Parkway toward Back River. From the 19th to the mid-20th century, this road served as a major transportation route to and from the Island. Today, its remnants are in slow decay. The road begins with a paved, macadam apron that leads to gravel and asphalt extending the length of the

Neck of Land marsh. Groups of ornamental perennials are found near a house foundation and along the western side of the road trace. A portion of the paved area leading towards the marsh is used as a service area by the NPS.

Near the beginning, or northern end, of Old Route 31, is another road trace. It joins Old Route 31 and turns into a cul-de-sac, never rejoining the Colonial Parkway. This second road trace is covered with vegetation and not used by vehicular traffic.

Neck of Land contains a number of small-scale features that reflect its history. Two brick headwalls, a culvert, and drainage ditch are stormwater features associated with the Colonial Parkway and the road traces. Box-wire fencing and wood post remnants relate to previous agricultural periods at Neck of Land.

The most substantial structural feature at Neck of Land is the masonry foundation from a previous log home. Acquired in 1943 with the adjacent land, the building became employee housing until it was demolished by the NPS in 1969.

Across the Colonial Parkway and partially screened by vegetation is the NPS Jamestown Maintenance Facility. Surrounded by a gated chain-link fence, access roads from this complex lead to Neck-O-Land Road and the Colonial Parkway. Built in 1957, this cluster of buildings provides the maintenance staff with a place to store equipment and supplies.

Two buildings are constructed of concrete block and contain offices, working areas and equipment storage. Another building serves as a concrete block fire cache. The fourth building is a pre-fabricated storage shed. Adjacent to the maintenance area and Neck-O-Land Road is a one-story frame house built as a park residence during the Mission 66 period and altered later with vinyl siding.

Table 3-6 summarizes the landscape features at Neck of Land. The table also includes whether they are features that contribute to the cultural landscape as historic features or structures.

Table 3-6: Summary of Landscape Features – Neck of Land

| Buildings, Structures, Objects & Spatial Organization | | | Small-Scale Features | | |
|---|---|-----------------------|----------------------|----------------|-----------------------|
| Item | Date Installed | Contributing (Yes/No) | Item | Date Installed | Contributing (Yes/No) |
| Mission 66 Maintenance Buildings | 1957 | Yes | Brick Headwalls | 1957 | Yes |
| Ornamental Planting at Log Cabin Ruin Site | Ca. 1900 | No | Concrete Culverts | 1957 | Yes |
| Service Spur Corridor | 1956 | Yes | Earthen Ditch | Not Determined | Not Determined |
| Park Residence | 1962 | No | Wooden Post and Gate | Current | No |
| Old Route 31 Road Trace | 19 th – 20 th century | Yes | Box Wire Fencing | Not Determined | No |
| Log House Foundation Ruins | c. 1900 | No | | | |
| Vegetative Screen at Maintenance | 1957 | Yes | | | |
| Maintenance Complex Service Road | 1957 | Yes | | | |

Colonial Parkway

A number of natural systems and features shape the landforms that helped determine the layout of the Colonial Parkway. The construction of the Parkway within Jamestown Island resulted in new stretches of flat, low-lying land (originally wetlands) created by a hydraulic fill process. The isthmus is also a result of this process. The Parkway's alignment follows the terraces on Neck of Land, crosses Powhatan Creek, and continues on a ridge toward the Island to end as a parking area on the high point of a terrace. This is the visitor parking area near the wooden footbridge.

Vegetation along the Parkway varies from minimally managed natural areas to more intensively managed planted areas. Mowed lawns, pine/oak forest, and specimen trees edge the Parkway boundary as it moves from Neck of Land to the Island. Wetlands line the edges along Powhatan Creek and Sandy Bay. Parking lot vegetation consists of mature native tree species planted at the time of parking area construction. Species include American sycamore, various oaks, and loblolly pines. In addition, extensive areas of exotic invasive vegetation result from either the original landscape plan, disturbance during Parkway construction, or ongoing NPS maintenance practices.

Vegetation creates enclosed spaces along the Parkway as it leaves Neck of Land. At Powhatan Creek, forest gives way to marsh, and expansive views of Jamestown Island can be seen from the bridge. Past the creek, vegetation again creates enclosed spaces along the Parkway until the isthmus is reached. From here there are dramatic views from the Parkway of the marshland habitat, Sandy Bay, the James River and river traffic, Surry County, and the Jamestown-Scotland Ferry. At the parking lot, the space is once again enclosed and shaded by mature trees. Organized into four bays, the parking area is divided by four wide, linear medians containing trees and paths. A smaller, circular bus parking area is adjacent to this lot and is lined with mature trees.

The Colonial Parkway is the only route on and off Jamestown Island. The road system extends beyond the study area boundaries to its terminus in Yorktown. The three-lane, exposed concrete aggregate road ends at the Island entrance gate. At that point, the Parkway changes to an asphalt surface treated with pea gravel, terminating in the Island parking lot. Within this system, the Parkway contains a variety of circulation features including overlooks, paved medians, and paths within the parking lot. The Island Loop Drive connects to the Parkway at the eastern end of the parking lot.

Nearly all structures built in 1958 along the Parkway still exist today, with the exception of the entrance station facilities. The entrance station area forms a distinct cluster of modern buildings. At the entrance are two frame and glass booths between the Parkway lanes. Directly west of the entrance booths is the single-story ranger station. In 1958, one entrance booth and ranger station existed. During the 1976 expansion and renovation, these structures were demolished and replaced with the existing structures described above.

An entrance sign lies just east of the entrance booths, providing a visual gateway into Jamestown Island. The bronze plaque located at its brick base establishes this sign as a commemorative piece by the Westmoreland Davis Memorial Foundation. Installed in 1957, it is a wattle fence that reflects the kind of building construction that occurred during the 17th century. While the brick base is original fabric, the wooden members have had to be replaced in kind as they rotted over time.

Two concrete bridges are part of the Parkway within the Jamestown Project site. Both were completed in time for the 1957 Jamestown commemoration. The 725-foot-long Powhatan Creek bridge is a cast-in-place post and beam structure with low, post and lintel guardrails. The Isthmus bridge, which connects Jamestown

Island to the mainland, is a simple, reinforced concrete deck structure built on steel I-beams with reinforced concrete substrate on timber piles. Both are listed on the *National Park Service List of Classified Structures* and designated as contributing features to the Parkway.

Small-scale features characterizing the Colonial Parkway within the project area are primarily associated with infrastructure of the road. They include culverts and headwalls, drainage grates, concrete and grass swales, guardrails, and regulatory and informational signage.

Other features include picnic tables, trash receptacles, tree wells, and utility lines. The *Cultural Landscape Report* (OCULUS 2002) will be describing these features in detail in future submissions.

Table 3-7 summarizes these features, as well as the buildings, structures, and objects found in the landscape of the Colonial Parkway. The table also includes whether they are features that contribute to the cultural landscape as historic features or structures.

Table 3-7: Summary of Landscape Features – Colonial Parkway

| Circulation, Structures, Objects, Spatial Organization & Vegetation | | | Small-Scale Features | | |
|---|----------------|-----------------------|------------------------------------|----------------|-----------------------|
| Item | Date Installed | Contributing (Yes/No) | Item | Date Installed | Contributing (Yes/No) |
| Views along the Parkway | 1957 | Yes | Culverts | 1957 | Yes |
| Ranger Station | 1976 | No | Grass Swales | 1957 | Yes |
| Powhatan Creek Bridge | 1957 | Yes | Concrete Swales | 1957 | Yes |
| Isthmus Bridge | 1957 | Yes | Culvert Headwalls | 1957 | Yes |
| Pedestrian Paths at Parking Lot | 1957 | Yes | Wooden Guard Rail | 1970s | No |
| Jamestown Parking Lot | 1957 | Yes | Directional and Regulatory Signage | Current | No |
| Parkway Corridor, Including Wayside and Pull-offs | 1957 | Yes | Metal Interpretive Signs | 1957 | Yes |
| Specimen Trees and Turf Plantings along Parkway and in Parking Lot | 1957 | Yes | Tree Wells | 1957 | Yes |
| Entrance Station Paving and Islands | 1957 | Yes | Flagpole | Unknown | |
| Jamestown Entrance Booths and Alterations for Second Booth | 1976 | No | Brick and Wattle Entrance Sign | 1957 | Yes |
| | | | APVA and Arrowhead Entrance Signs | Current | No |
| | | | Drainage Grates | 1957 | |
| | | | Curbing | 1957 and 1976 | |

3.3.1.5 Archives and Collections

The museum collection for both the APVA and NPS currently includes approximately 1 million objects, including both prehistoric and historic assemblages from the 17th through 20th centuries.

APVA Collection

The APVA collection includes materials from early excavations of the Jamestown church and statehouse foundations, as well as artifacts from NPS excavations on APVA Jamestown property in 1941 and the 1950s. There are also numerous objects without any context beyond “Found on APVA Property” that have been turned into the NPS curator for storage over the years. Also in the collection are objects from a number of 17th century sites off the Island whose study relates to the understanding of Jamestown, as well as more than 350,000 artifacts from the ongoing Jamestown RediscoveryTM excavations begun in 1994 on the Island. This archaeological work is adding at least 50,000 artifacts per year to the collection. Materials range in date from Virginia's late Archaic Period (6000 BP) to the 20th century, but the primary collection relates to the Virginia Company period of control of the Jamestown colony, ca. 1607-24. This important and unique assemblage includes ceramic, glass, metal, bone, and lithic artifacts, many of which were excavated from sealed contexts dating to the first three years of settlement. Of particular importance is the large assemblage of military objects that contains some of the only known examples of arms and armor with provenience⁴. The artifact collection's uniqueness, its derivation from tightly dateable contexts relating to the first years of the colony's settlement, and its association with a large body of primary documents make it one of the most significant in the world.

Refurbishment of the 1907 Yeardley House on Jamestown Island was completed in 1999, providing facilities for the Jamestown RediscoveryTM staff offices and the APVA

archaeological collections. The collections are stored in a new 1,700-square-foot wing on the back of the building. This vault-like structure encompasses two floors, the second consisting of a steel grid and beam mezzanine where the bulk of the collections are stored. Storage in this area is by provenience in acid-free banker's boxes on a Spacesaver mechanical assist system.

The floor-level area houses the study collection in white metal geological specimen cabinets. These artifacts have been pulled from the bulk collection for further study or because they are representative examples of the material excavated from each context. This is the area where the artifacts are cataloged on Re:discovery Software, and a networked computer is provided for this purpose. Three large wooden tables with sliding lower shelving provide space for laying out collections for study and for the mending and cross-mending of ceramics. Maps, graphs, plans, and artwork are stored in a large flat file on one end of the room.

The collections room is bright and airy, receiving abundant natural light from four 7-foot-long windows. Bulletproof glass and metal roll-down storm shutters are on each window to provide security against theft and adverse weather. In addition, the room is connected to the Ademco Partitioned Security System in effect throughout the first floor of the Jamestown RediscoveryTM Center. This system uses microcomputer technology to monitor all protection zones and system status and provides appropriate information on keypads used with the system. The system is programmed to automatically transmit alarm or status messages over the phone lines to a central alarm monitoring station. Other features of the room include a wide two-door loading bay on one side for shipping or receiving materials. In addition, a photographic alcove provides space for studio photography and houses the extensive Jamestown RediscoveryTM slide collection.

⁴ Source or origin.

Climate control is achieved by a direct digital control building automation system monitored by Mid-Atlantic Controls Corporation. There is a special “dry room” for the storage of metal artifacts, which is maintained at a humidity level below 25%. This establishes a stable environment for iron materials that stops rusting in unconserved objects and prevents flash rust in conserved artifacts. The building is made of fire-resistant materials and is monitored for fire and smoke 24 hours a day. Presently, there is no suppression system due to the lack of connection with the public water system. Although the Yeardley House itself is above the 500-year floodplain elevation (9.8 feet), a short stretch of the access road to it is not.

Portions of the APVA collection are also exhibited, handled, or stored in areas outside the Yeardley House. Technical work such as cleaning of individual items (conservation of artifacts) takes place in the Dale House, 200 yards from the collections storage facility. Once artifacts are conserved, they are moved into the Jamestown Rediscovery™ Center for permanent storage. The Dale House comprises approximately 1,200 square feet, of which 160 is gallery space containing an exhibit for visitors. A conservation area in the Dale House totals about 75 square feet with space for mechanical equipment as well as storage for chemicals and laboratory supplies. The Dale House is protected by the same security system as the Jamestown Rediscovery™ Center; it has no special environmental controls.

Archival materials related to the APVA’s ownership and legacy on the Island are currently stored in the APVA’s Richmond, Virginia office and include approximately 275 items including photographs, maps, blueprints, and journals from 1893 to the present. In addition, the Richmond APVA office contains approximately 25 objects related to Jamestown anniversary events. These objects document events in 1907 for the Tercentenary and in 1957 for the 350th anniversary, as well as more institutional events related to the APVA’s history.

The condition of the collection is very good, with a conservator on staff. Nearly 100% of the collection is catalogued using the collections and archaeological modules of the Re:discovery software system. Less than 1% of the collection is exhibited at Jamestown because there is a lack of appropriate exhibition space. Objects are frequently loaned nationally and internationally to those museums that meet the APVA’s criteria for such loans.

NPS Collection

The NPS Jamestown museum collection consists of approximately 600,000 items, primarily archaeological objects and their documentation from 70 years of archaeological excavations at Jamestown Island, Glasshouse Point, and Neck of Land. It includes a large and varied ceramics collection, glass, and architectural fragments, a wide variety of tools and equipment, and American Indian artifacts. Most of this material dates to the 17th century and was recovered in archaeological excavations in 1934-41, 1948-49, 1954-56, and in the Jamestown Archeological Assessment of 1992-96. New Towne produced most of the artifacts while others came from the Elay-Swann tract, the Travis graveyard, and scattered sites on the Island. Areas on Glasshouse Point and Neck of Land have also been excavated. Additionally, objects have been recovered from Governor William Berkeley’s mansion site, Green Spring, about three miles away.

Some of the unique items in the Jamestown museum collection include pottery manufactured ca. 1630-45 at Jamestown, some of the earliest American ceramics in existence. The Wormeley bottle seal with the initials “RW” – attributed to Ralph Wormeley I, who died in 1652 – is the earliest seal that can be linked to a Virginia colonist. The Copeland spoon (dated 1675) is the oldest known pewter object made in America. The Jamestown collection also includes the world’s largest collection of complete North Devon slipware. Ornate plaster excavated from a cluster of buildings in New Towne is believed to represent the Order of the Garter. A British researcher with expertise in plaster declared that it equaled or surpassed the quality of

any contemporary work in England (Colonial NHP 1988). Two Clovis points discovered during the Jamestown Archeological Assessment date to about 10,500 BP, indicating that occupation of the Island occurred thousands of years earlier than former estimates. Numerous objects, including melting pots and glass cullet, survive from the 1608 glasshouse.

The NPS Jamestown archives account for about 10,000 items (13 linear feet) that document the museum collection through reports, field books, correspondence, photographs, maps, and drawings. Additional material covers Jamestown history (35 linear feet), including the papers of former curator J. Paul Hudson. There are about 150 paintings and drawings, with more than half being the work of Sidney E. King. These paintings vary in size from about 8 by 10 inches to 4 by 8 feet, the latter requiring special hangers and crates for storage.

The collection also includes hundreds of commemorative objects and printed materials (3 linear feet) documenting anniversaries and special events in Jamestown history. These include objects from the 1907 Tercentennial, the 1957 Festival, the annual Jamestown Day, items and planning documents for the upcoming 2007 quadricentennial, and other noted observances.

Almost 100% of the collection has been cataloged under the NPS Automated National Catalog System (ANCS+), which provides location and documentation of artifacts without unnecessary handling. All new archaeological projects completed under contract include processing, cataloging and preparing artifacts for storage. Less than 1% of the collection is on exhibit, and there are nine loans of approximately 70 artifacts to other institutions.

The museum collection storage area is about 3,000 square feet. Located in the basement of the Visitor Center constructed in 1957 and remodeled in 1976, the space was considered state-of-the art for museum storage. It housed both the Jamestown and Yorktown NPS collections as well as about 17,000

artifacts from excavations on APVA property. The Yorktown and APVA collections are no longer stored there. However, the massive 10-year project to catalog the collection required additional storage cabinets, and space is still very tight. The storage and curator's offices generally meet fire suppression and security standards. The fire suppression system depended on well water until recently. In 2001, installation of a water main from the mainland ensured a continuous supply of water in case of fire.

NPS collections management and preservation is provided for in several guidance documents, including the *Museum Handbook* (NPS 2000e), the *Cultural Resource Management Guideline* (NPS 1997a), and *Curation of Federally-Owned and Administered Archeological Collections* (36 CFR 79). The museum storage space no longer meets these museum standards, which state that collections should be stored outside the 500-year floodplain (NPS *Floodplain Management Guideline* 93-4), that pipes and mechanical systems should not be located within the storage area, and that supplies and materials should be stored separately from the collection. Based on the park's self assessment using the NPS *Checklist for Preservation and Protection of Museum Collections*, the storage conditions in the Jamestown Visitor Center meet approximately 70% of the standard criteria, and many of the standards cannot be met by modifying the existing storage space.

In addition, a 1992 museum security report (McDaniel) found that an exterior wall of windows to the curator's office makes the office vulnerable to vandalism and violent weather. Although the museum storage area has climate control, frequent power outages at Jamestown and imperfections in the existing system can increase humidity to 80%, exceeding the threshold for development of mold. The lack of adequate and appropriate space for scholars to work with the artifacts also puts the collection at risk of damage and theft.

The overall condition of the museum collection is good, as it has been in a relatively stable environment for the past 25 years. However, a condition survey of the artifacts is needed, as are appraisals of their values. Project Management Information System (PMIS) statements have been completed for both of these needs.

3.3.2 Physical and Natural Resources

The physical and natural resources of Jamestown Island and surrounding lands were significant contributors to both the success and failure of the original Jamestown colony. The early English settlers, in some of their writings, expressed their amazement of the plentiful supply of fish, wildlife, and forest resources at their disposal. In particular, they encountered trees the size of which they had never experienced, peculiar animals never before recorded, and wildlife populations whose densities were startling. Once farming and animal husbandry became the mainstay source of revenue and livelihood, portions of the virgin timber of the Island were cleared for the expansion of these land uses. On the other hand, the unpredictable climate, insects, and cold winters, contributed to the settlement's early "starving time" and near failure.

Since that time, changes in the human population and uses of the resources have altered the surrounding landscape, plant life, and animal populations. Jamestown Island, as part of the APVA and NPS properties, has been somewhat immune to the most recent and dramatic changes of other, nearby properties. Portions of the property remain as fields and yards for interpretive purposes, probably not unlike the 18th and 19th centuries when the Island was inhabited and farmed. However, some of the abandoned farmed areas have naturally converted back to second-growth forests, unique in the area for their age and maturity. Below is a descriptive summary of the existing natural and physical conditions at the Jamestown Project site, which displays the diversity and value of the area.

3.3.2.1 Physiography, Topography, and Climate

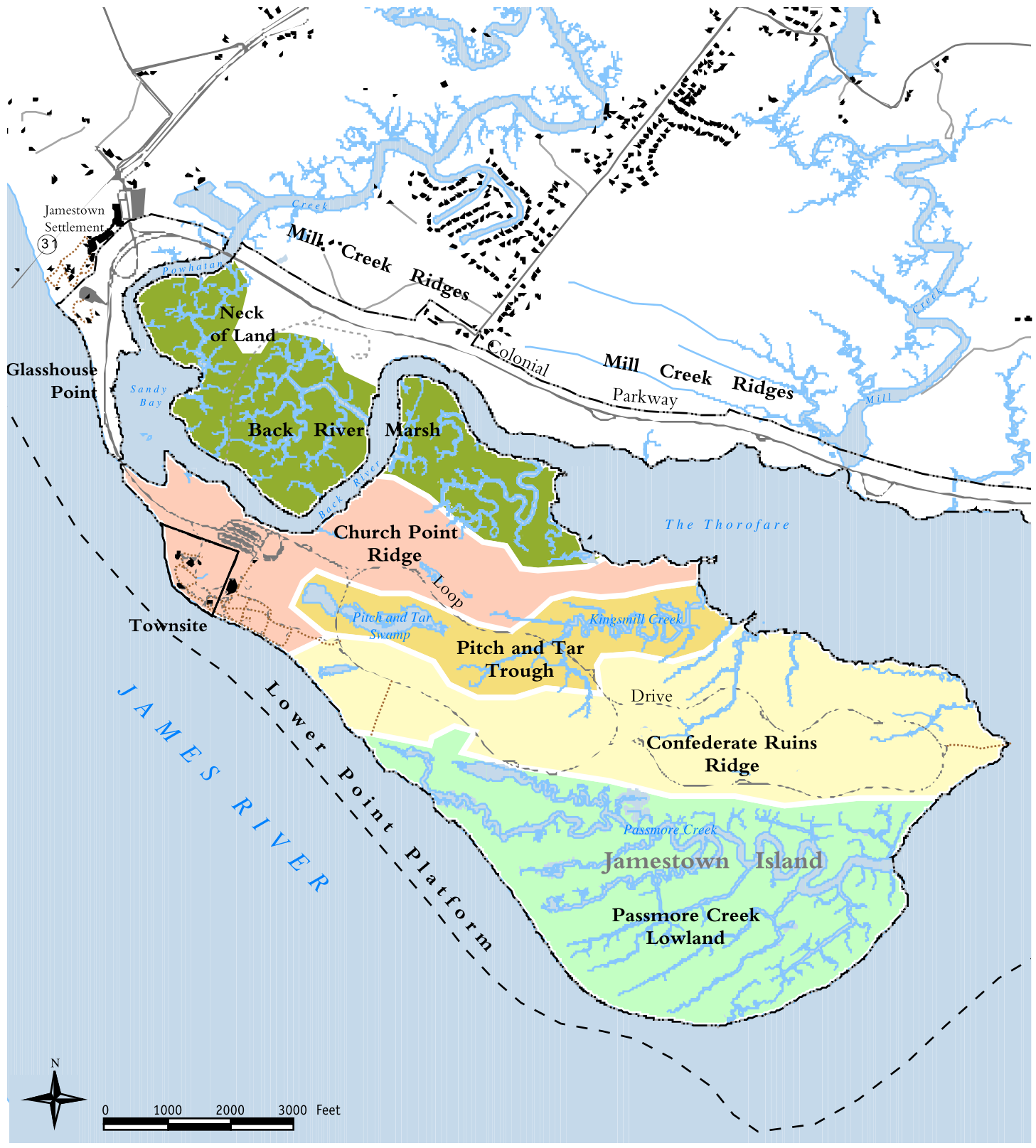
Virginia is divided into five physiographic provinces (from west to east): the Appalachian Plateaus, the Ridge and Valley, the Blue Ridge, the Piedmont Plateau, and the Coastal Plain. Due to the presence of the Chesapeake Bay and its tributaries – the Potomac, Rappahannock, York, and James Rivers – the Coastal Plain Province is divided into four peninsulas: Northern Neck, Middle Peninsula, The Peninsula or York-James Peninsula, and the Eastern Shore. Just south of the James River (and Jamestown Island), the Coastal Plain Province is split by the Suffolk Scarp into an Inner (or Upper) Coastal Plain and an Outer (or Lower) Coastal Plain. The Jamestown Project site is located on the James-York Peninsula, just north of the Suffolk Scarp and James River (Figure 3-5).

Because of its close proximity to the Chesapeake Bay and the Atlantic Ocean, the topography of the Jamestown Project site is relatively flat, with elevations ranging from at or below sea level to 20 feet above sea level. The topography typically follows a ridge and swale pattern. The higher elevations are mostly found along the Colonial Parkway, at Glasshouse Point, and within the northern portion of Neck of Land. The *Geological Development and Environmental Reconstruction of Jamestown Island* (Johnson et al. 2000) divides the Jamestown Project site into eight natural landscape regions, based on elevation, distinctive landforms, and vegetative/hydrographic features. The regions consist of the Mill Creek ridges, Back River marsh, Church Point ridge, Pitch and Tar trough, Confederate Ruins ridge, Passmore Creek lowland, Lower Point platform, and James River thalweg (Figure 3-6).

The climate at the Jamestown Project site is typical of the Virginia coastal plain region. Average winter temperatures range from –3°C (25–30°F) to 10°C (50°F), while average summer temperatures range from 20°C (60°F) to 30°C (85–95°F). Precipitation averages 45 inches per year, with 50% falling between April and September (Colonial NHP 1999).



Figure 3-5: Physiographic Provinces & Virginia Coastal Plain



Legend







| | | | |
|---|-------------------------|---|----------------------|
|  | Back River Marsh |  | Pitch and Tar Trough |
|  | Church Point Ridge |  | James River Thalweg |
|  | Confederate Ruins Ridge | | |
|  | Passmore Creek Lowland | | |

Figure 3-6: Physiographic Landscape Regions

Source: *Geological Development and Environmental Reconstruction of Jamestown Island*, Jamestown Archeological Assessment, Johnson et al., 2000

3.3.2.2 Geologic Setting

As noted above, the Jamestown Project site is located within the Coastal Plain Province of Virginia, which consists of a thick sequence of nonmarine deposits overlain by a thinner sequence of marine deposits. According to the *Geologic Map of Virginia* (VDMME/VDMR 1993) the majority of the project site is classified as Quaternary and Tertiary deposits, undifferentiated. These deposits consist of the Tabb Formation, Poquoson Member, Lynnhaven Member, Sedgefield Member, Shirley Formation, Chuckatuck Formation, Charles City Formation, Windsor Formation, and alluvial/tidal prism deposits. The remaining area (a small portion of Neck of Land and the Colonial Parkway east of Powhatan Creek) consists of the Sedgefield Member.

As part of the NPS Jamestown Archeological Assessment, the *Geological Development and Environmental Reconstruction of Jamestown Island* (Johnson et al. 2000) was prepared. The goal of the project was to establish the stratigraphic framework and geologic history through the late Cenozoic Era, as well as determine historical surface features and natural resources, and compare these to the existing conditions. This document provides a very detailed description of the geology of Jamestown and the historical and existing processes that have caused major changes to the physiographic and geologic resources. The rise of sea level (approximately 4 feet since 1607, and rising) has been and will be an important factor in determining the landscape at Jamestown. In addition, flooding and shoreline erosion have brought about the most significant changes.

According to the *Geological Development and Environmental Reconstruction*, the Kennon and Tabb Formations are the surficial units found at Jamestown while the Eastover Formation forms the foundation upon which Jamestown Island was built. The Kennon Formation is an informal name for the fluvial, estuarine, paludal, aeolian, and marine sediments deposited during deglaciation. It

is typically composed of a thin, light gray, pebbly sand and an intermediate medium sand that grades upward into a very silty, clayey fine sand with increasing organic content. The uppermost unit is typically a dark gray to black organic-rich mud.

As the estuarine and paludal deposits of the Kennon Formation subsequently buried the Tabb Formation, the availability of useable lithic and freshwater resources declined. This is very important because most human activities, such as brick making, agriculture, forestry, and building, relied on the Tabb for raw materials and suitable soils. The Tabb Formation is composed of three members: Sedgefield, Lynnhaven, and Poquoson. Each member typically has the same sequence of unfossiliferous strata: a thin basal sand and gravel; a thick medium to fine sand, commonly with interbedded thin, pebbly gravel; and a cap of fine sandy and silty clay. Each member is usually less than 33 feet thick. The older and topographically higher Sedgefield Member crops out on high ridges north of Back River and along the Colonial Parkway. The Lynnhaven Member is typically observed on the centralized uplands and ridges on Jamestown Island and was deposited by the ancestral estuarine James and Back Rivers. The youngest and topographically lower member, the Poquoson, is located along the ridges within the Passmore Creek lowlands.

The Eastover Formation, which the Kennon and Tabb Formations lie upon, is subdivided into two parts: the lower Claremont Manor and upper Cobham Bay Members. At the Jamestown Project site, the Cobham Bay Member has eroded away and is no longer present. The Claremont Manor Member consists of sparsely fossiliferous, compact, medium to massively bedded, fine sandy and silty clay. The Eastover Formation is not exposed on the Jamestown Project site but is visible in deep valleys within upland areas and bluffs along the north and south banks of the James River. Figure 3-7 depicts the exposed geologic units at the Jamestown Project site.

3.3.2.3 Soils

The soils at the Jamestown Project site are mapped and described in the *Soil Survey of James City and York Counties and the City of Williamsburg, Virginia* (USDA 1985). Several soil types are present at the Jamestown Project site, the majority of which are sandy loams, silt loams, Bohicket muck, and Levy silt clay. Figure 3-8 depicts the distribution and classification of soils within the study area, and the major soil types found at the project site are described in detail below. No known unique agricultural soils were identified within the Jamestown Project site; however, prime farmland and hydric soils are located at the site and discussed below.

Soil Types

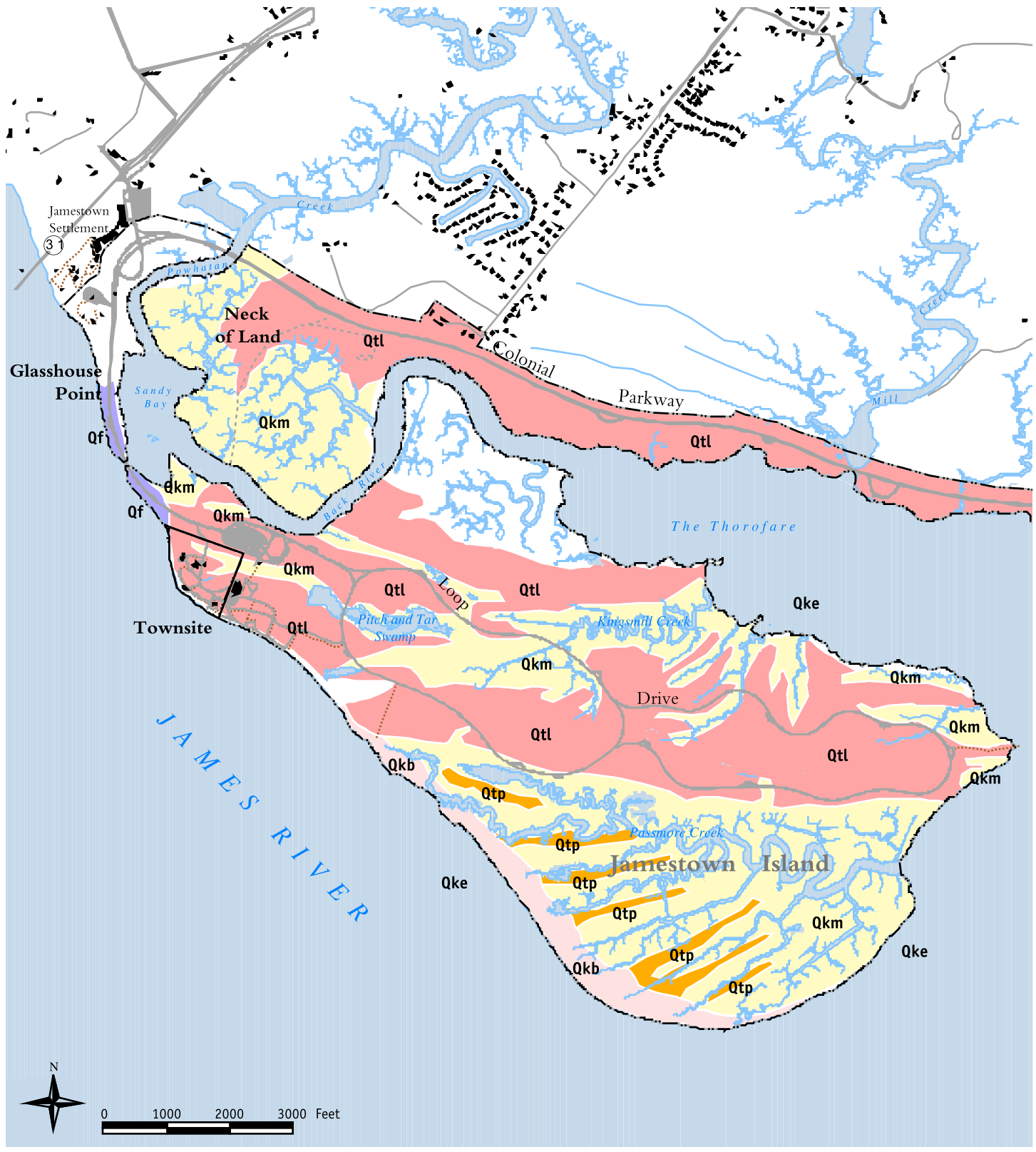
Bohicket Muck. The soils surrounding Kingsmill Creek and Passmore Creek of Jamestown Island are classified as Bohicket muck. The Bohicket muck soil type is characterized by nearly level and very poorly drained soils and is found on tidal marshes. Slopes of this soil formation are less than 1%. The permeability of the Bohicket soil is very slow, and the available water capacity is high. Surface runoff is very slow, and the soil has a high natural fertility. The substratum has a high shrink-swell potential. The soil ranges from slightly acidic through moderately alkaline. Bohicket soils are flooded daily by tidal water and are continuously saturated. In most areas, the soil supports saltwater-tolerant grasses and forbs. This soil is unsuitable for most uses other than wetland wildlife habitat. Bohicket muck is listed on the United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) hydric soils list (1991).

Craven-Uchee Complex. The Craven-Uchee complex soils consist of moderately well drained Craven soils and well-drained Uchee soils. They are located in bands along the Colonial Parkway and within uplands bordering the wetlands at Neck of Land and Back River Marsh. They are strongly sloping soils (6-10% slopes) and are so intermingled that it is not practical to separate them. In Craven

soils, the permeability is low, while in Uchee soils the permeability is moderate in the upper part and moderately slow in the lower part. The available water capacity is moderate for the Craven soils and low or moderate for the Uchee soils. Surface runoff is rapid and the erosion hazard is severe throughout the complex. The surface layer in both soils is friable (easily crumbled), and the subsoil has a moderate shrink-swell potential. The soils are poorly suited for cultivating crops but moderately well suited for pasture and hay crops. The USDA designates Craven soils as prime farmland soils. The potential for trees on this complex is moderately high, especially for loblolly pine, Virginia pine, sweetgum, and oak. With regards to building and site development, Craven-Uchee complexes range from generally favorable to favorable with some special planning and design.

Dogue loam. Bands of Dogue loam are located along the Colonial Parkway and within the uplands at Neck of Land and Jamestown Island. This soil is deep, nearly level, and moderately well drained. It is typically found on narrow ridges and low-lying terraces, and slopes range from 0% to 3%. Included within the mapped units of Dogue loams are small areas of Pamunkey, Altavista, Peawick, Newflat, and Chickahominy soils. Permeability of this mapped unit is moderately slow, and available water capacity is moderate. Surface runoff is slow while erosion hazard is slight. This soil type is well suited to pasture and is designated by the USDA as a prime farmland soil. In addition, the potential for trees is high. Building and site development using this soil type typically requires some special planning and design or is so unfavorable that constraints are difficult to overcome.

Levy Silty Clay. Two large areas of Levy silty clay are located within the Back River and Neck of Land marshes. Smaller areas of the Levy soils are also located along the banks of the Powhatan Creek, Sandy Bay, Back River, The Thorofare, and Mill Creek. The Levy silty clay is nearly level and very poorly drained. It is located in tidal marshes and has slopes less than 1%.



Legend







| | | | | | |
|---|-----|--------------------|---|-----|----------------------|
|  | Qf | Kennon Fill |  | Qtp | Tabb Poquoson Member |
|  | Qkm | Marsh Deposits |  | Qtl | Lynnhaven Member |
|  | Qke | Estuarine Deposits | | | |
|  | Qkb | Beach Deposits | | | |

Figure 3-7: Exposed Geologic Units

Source: Geological Development and Environmental Reconstruction of Jamestown Island, Jamestown Archeological Assessment, Johnson et al., 2000

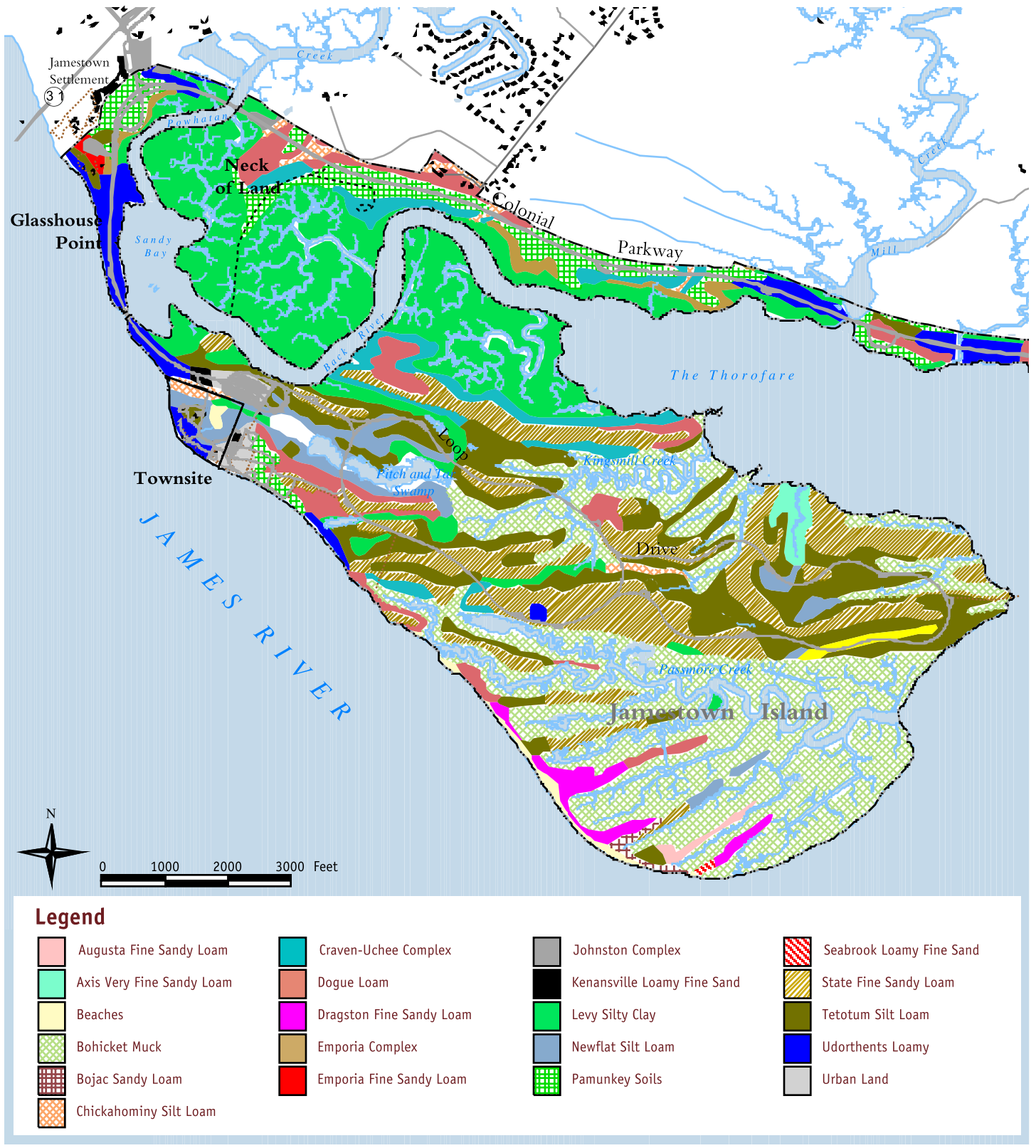


Figure 3-8: Soil Types

Source: *Soil Survey of James City and York Counties and the City of Williamsburg, Virginia*, USDA Soil Conservation Service, 1985

The permeability of Levy soils is slow, and the available water capacity is high. Surface runoff is very slow, and the substratum has a high shrink-swell potential. The soil has medium natural fertility and is very strongly to strongly acidic throughout. The soil is flooded daily by tides and is continuously saturated with water, making the soil unsuitable for farming and development.

Vegetation typically consists of water-tolerant grasses and forbs, including arrowleaf, cattails, giant cordgrass, and lilies. Levy soils are listed on the NRCS hydric soils list (1991).

Newflat Silt Loam. Elongated bands of the Newflat silt loam are located to the north and south of Pitch and Tar Swamp. Pockets of this soil are also located along the eastern portion of Jamestown Island. The Newflat silt loam is described as a nearly level, somewhat poorly drained soil. It is located on broad flats of intermediate river terraces, and slopes range from 0% to 2%. The permeability in this map unit is very slow, and the available water capacity is moderate. Surface runoff is slow, and the erosion hazard is slight. The surface layer is friable, and the subsoil has a high shrink-swell potential. The soil is low in natural fertility and extremely acidic. The high water table is within 0.5 to 1.5 feet of the surface. Most of the acreage in the map unit is woodland. The soil is moderately well suited to cultivated crops and is well suited to pasture and hay crops. The potential for trees on this soil is high. Newflat silt loams are not suitable for development.

Pamunkey Soils. Within the Jamestown Project site, Pamunkey soils are located at the Glasshouse area, along the Colonial Parkway, within the uplands at Neck of Land, and at the eastern end of the Townsite. The Pamunkey soils are gently sloping (2-6% slopes) and well drained. They are typically located on broad high terraces. Permeability and available water capacity are moderate. Surface runoff is medium, and the erosion hazard is moderate. The surface layer is friable, and the subsoil has a low shrink-swell potential. The soils have a medium natural fertility and are very

strongly acid through slightly acid. The soils are well suited to cultivated crops and are designated by the USDA as prime farmland soils. The potential for trees on these soils is high. Building and site development on this soil type ranges from generally favorable to favorable with some special planning and design accommodations.

State Fine Sandy Loam and Tetotum Silt Loam.

Bands of State fine sandy loam and Tetotum silt loam are located throughout the center and northern portions of Jamestown Island. Small pockets of Tetotum soils are also located within the Townsite and at the Glasshouse area. The State and Tetotum soils are classified as nearly level, well-drained soils present on low-lying terraces. Slopes of the State soils range from 0% to 3%, while slopes of the Tetotum soils range from 0% to 2%. The permeability and available water capacity of these soils is moderate, and the surface runoff is medium. The State soils have a light erosion hazard, while the Tetotum soils have a moderate erosion hazard. These soils are low in natural fertility and commonly very strongly acidic. The soils are well suited to cultivated crops, and in most areas, they are farmed. The productivity for trees in these soils is moderately high. Both the State and Tetotum soils are designated as prime farmland soils. With regards to building and site development, State soils range from generally favorable to favorable with special planning and design, while Tetotum soils typically range from favorable with special planning and design to unfavorable with constraints that are difficult to overcome.

Udorthents Loamy. One of the predominant soil types at Glasshouse Point is Udorthents loamy soil. Other areas of Udorthents soil are located in the Townsite and along the Colonial Parkway. One small area of this soil unit is located on Jamestown Island north of Passmore Creek. This soil type is moderately well drained. Slopes commonly range from 2% to 30% but can vary from 0% to 70%. The permeability ranges from moderately rapid to slow. The available water capacity ranges from low to

high depending on the texture and gravel content of the material. Surface runoff ranges from very slow to rapid, and the erosion hazard ranges from slight to severe. The soil is typically strongly to extremely acidic and is not suitable for cultivation. The potential for trees on this soil type is low. Soil characteristics related to development potential were not included in the soil survey.

Additional minor soils found at the project site include:

- Augusta fine sandy loam at the southern end of the Island;
- Axis very fine sandy loam at the northeast portion of Jamestown Island;
- Beaches along the southwestern shore and in the northeastern corner of the APVA property;
- Bojac sandy loam at the southern end of Jamestown Island;
- Chickahominy silt loam along the Neck of Land portion of the Colonial Parkway, at the northern edge of the APVA property, and in the center of Jamestown Island;
- Dragston fine sandy loam along the southern and southwestern portion of the Island;
- Emporia Complex at Glasshouse Point;
- Emporia fine sandy loam at the central portion of Glasshouse Point;
- Johnston complex at the northern end of Glasshouse Point and the western end of Neck of Land;
- Kenansville loamy fine sand at the western end of the parking lot;
- Seabrook loamy fine sand at the southern end of Jamestown Island; and
- Urban land at the parking lot and within the central portion of the Townsite.

Hydric Soils

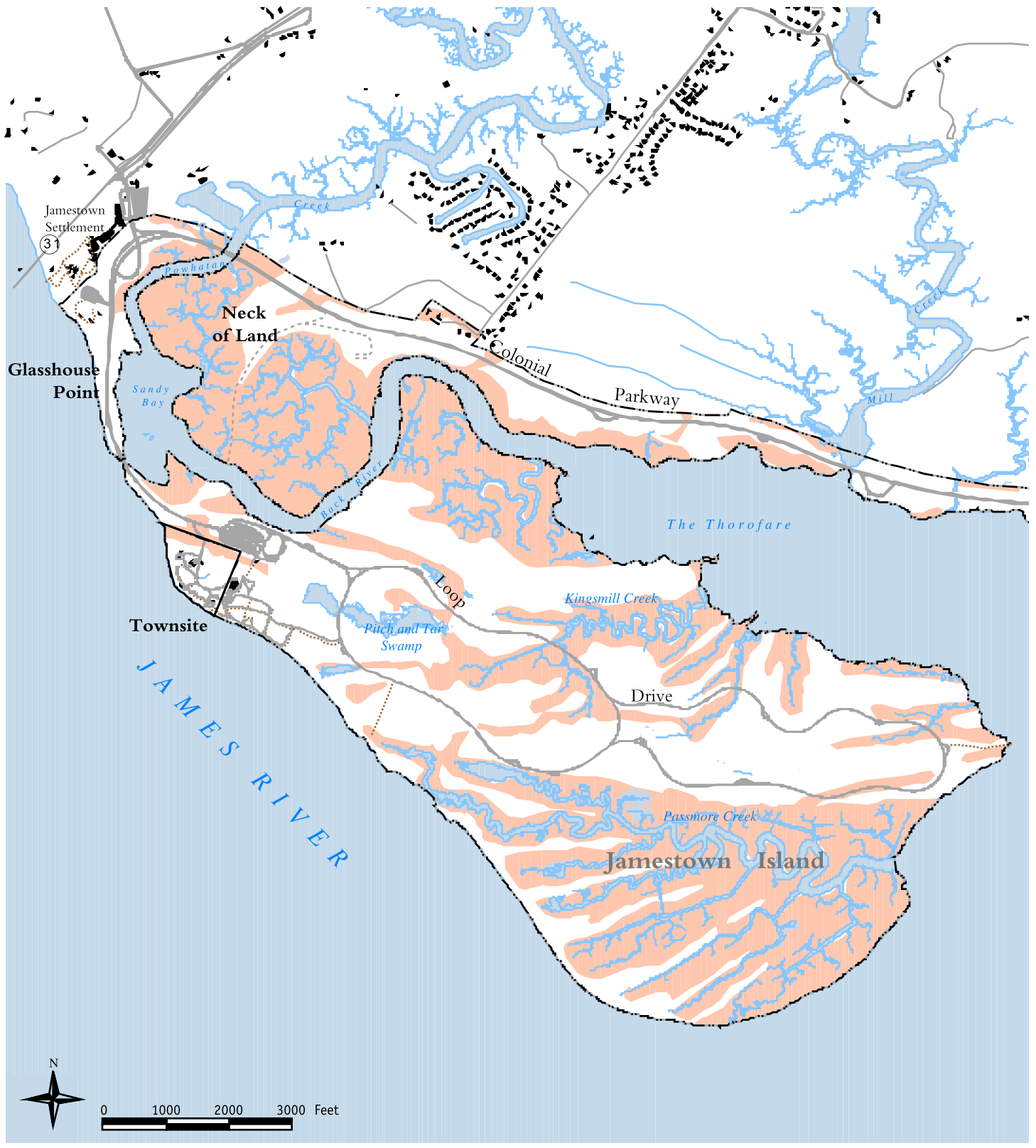
Hydric soils typically support the growth and regeneration of wetland vegetation and are thus important in determining the potential location of jurisdictional wetlands. By definition, “a hydric soil

is a soil that is saturated, flooded, or ponded long enough during the growing season to develop anaerobic conditions in the upper part” (USDA 1991). The USDA/NRCS designates the following soil types found at the Jamestown Project site as hydric: Axis, Bohicket, Chickahominy, Johnston, Kenansville, and Levy (1991). Hydric soils cover approximately 934 acres (50%) of the Jamestown Project site (Figure 3-9).

Prime Farmland Soils

Prime farmland is one of several designations made by the USDA to identify important farmland in the United States. The Farmland Protection Policy Act, the Virginia Agricultural and Forestal District Act, and the Virginia Agricultural, Horticultural and Food Act provide for the protection of prime farmland and other agricultural resources. Prime farmland is important because it contributes to the nation’s short- and long-range needs for food and fiber. Characteristics of prime farmland include an adequate moisture supply, a sufficient growing season, and other properties favorable to sustained, high-yield crops. Urban or developed areas cannot be considered as prime farmland.

Prime farmland soils, as defined by the USDA, are soils that are best suited to producing food, feed, forage, fiber, and oilseed crops. They only need to be treated and managed using acceptable farming practices. Prime farmland soils have acceptable alkalinity or acidity levels, have no rocks, and are permeable to air and water. They may currently be in use for crops, pasture, or woodlands, but they are still considered as prime farmland soils. Soil types in the study area that are classified as prime farmland soils include: Augusta, Bojac, Craven, Dogue, Dragston, Emporia, Pamunkey, State, and Tetotum soils. Prime farmland soils cover approximately 702 acres (40%) of the Jamestown Project site (Figure 3-10).



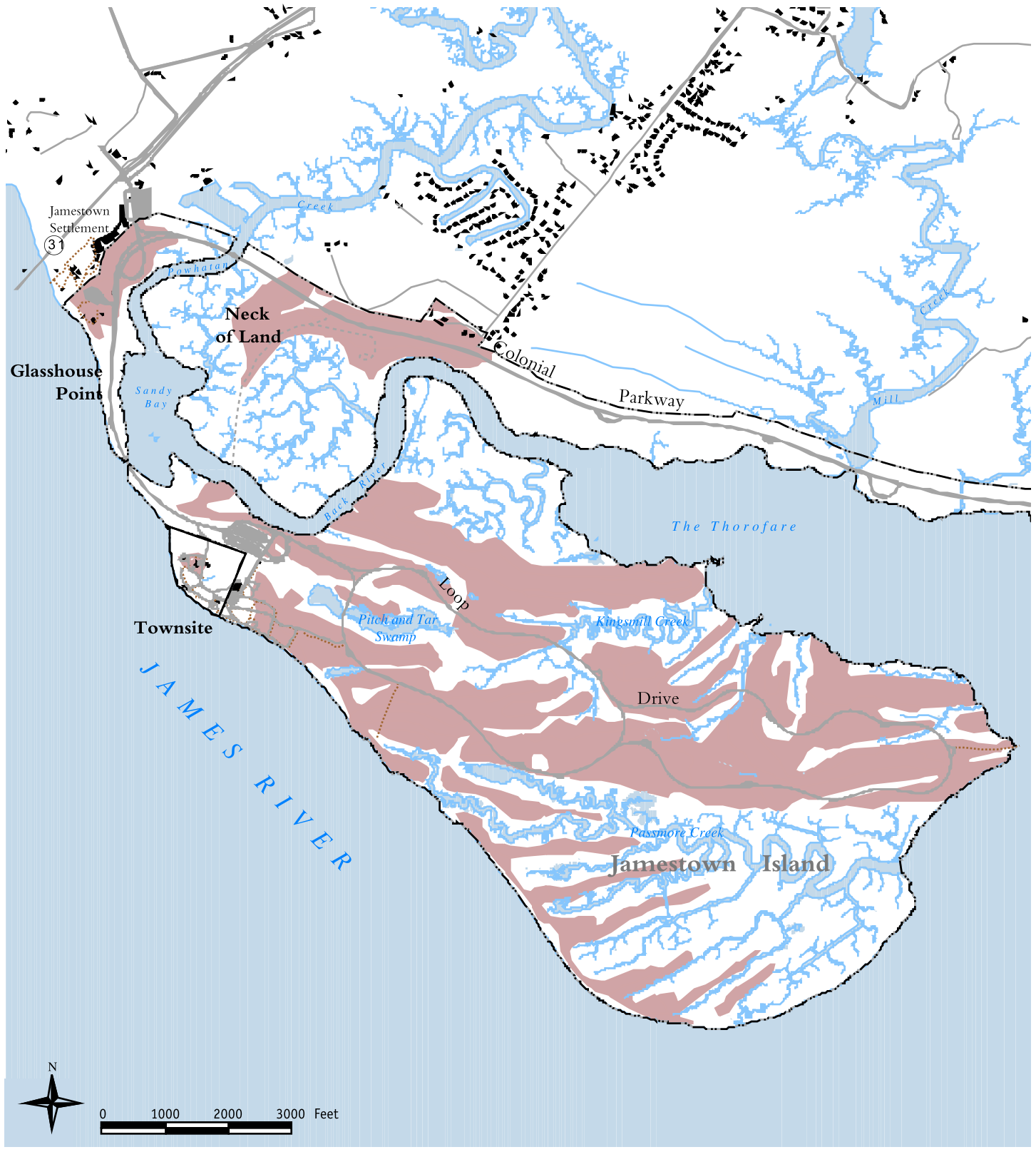
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Hydric Soils

Figure 3-9: Hydric Soils

Hydric soils cover 934 acres (50%) of the Jamestown Project area

Source: *Hydric Soils of the United States*,
USDA Soil Conservation Service, 1991



Legend

Prime Farmland Soils

Figure 3-10: Prime Farmland Soils

Prime farmland soils cover 702 acres (40%) of the Jamestown Project area.

Source: Soil Survey of James City and York Counties and the City of Williamsburg, Virginia, USDA Soil Conservation Service, 1985

3.3.2.4 Chesapeake Bay Resources

Jamestown and other parts of Colonial NHP are located within the Chesapeake Bay estuary system (Figure 3-5). An estuary can broadly be defined as a semi-enclosed coastal body of water that has a free connection with open sea and is affected by a measurable mixing of seawater with fresh water. The Chesapeake Bay is the largest estuary in the United States, with a watershed of more than 64,000 square miles covering parts of six states (Delaware, Maryland, New York, Pennsylvania, Virginia, and West Virginia). The Bay developed from natural occurrences during the last Ice Age. Around 11,000 BP, melting glaciers filled in the Susquehanna valley, and after 7,000 years of inundation and erosive forces, the Bay assumed its current shape. Today, the Bay is nearly 200 miles long and varies between 3 and 35 miles wide with an average depth of 23 feet.

The Chesapeake Bay is a well-mixed estuary: salinity is fairly uniform vertically through the water column, surface to bottom, but varies horizontally, ranging from fresh water above the tidal reach to the salinity of the open ocean at the mouth of the estuary. Salinity is 0 to 0.5 parts per thousand (ppt) at the head of the Bay and 30 to 35 ppt at the mouth. Within the Chesapeake Bay watershed, three rivers provide approximately 84% of the freshwater input to the Bay – the Susquehanna (48%), Potomac (26%), and James (10%). Figure 3-5 depicts the rivers of Virginia that contribute significantly to the Bay.

The Bay is the nation's largest and most productive estuary. The major tributaries and other smaller rivers, along with the hundreds of thousands of creeks and streams that feed them, provide habitat necessary for the production of many fish species. Anadromous fish (striped bass, blueback herring, alewife, shad, and sturgeon) spend their adult lives in the ocean but must spawn in freshwater. Semi-anadromous fish, such as white and yellow perch, inhabit tidal tributaries but also require freshwater to spawn.

The economic, commercial, and recreational values of the Bay are threatened, however, by pollution entering from its major tributaries. Each year, runoff from city streets, fertilizer-laden waters from farmlands, outflows from sewage-treatment plants, and airborne pollution carry large amounts of nitrogen and phosphorus into the rivers and ultimately the Bay. Nitrogen and phosphorus, also termed "nutrients," are considered pollutants because they nourish algal blooms that deprive Bay grasses of sunlight and deplete water of oxygen. This, in turn, kills fish and other plants and animals that make their home in the Bay, thereby affecting the commercial and recreational industries of Chesapeake Bay. From 1990 through 1992, 600 million pounds of nitrogen entered the Chesapeake Bay from its nine major tributaries. Most of that nitrogen (97%) came from the Susquehanna, Potomac, and James Rivers (Commonwealth of Virginia 2000).

The Chesapeake was this nation's first estuary targeted for restoration and protection. The Chesapeake Bay Program is a unique regional partnership that has been directing and conducting the restoration effort since the signing of the historic Chesapeake Bay Agreement in 1983. This cooperative effort among the states of Virginia, Maryland, and Pennsylvania; the Chesapeake Bay Commission; and the federal government has evolved over the years, reflecting the dynamic understanding of the restoration challenge. The newest agreement, Chesapeake 2000, will guide the next decade of restoration and protection efforts throughout the Bay watershed. The agreement commits to protecting and restoring living resources, vital habitats, and water quality of the Bay and its watershed. The agreement has cutting-edge commitments to correct nutrient and sediment problems in the Bay and its tidal tributaries, with the goal of taking them off the impaired water list (as defined under the Clean Water Act) by 2010. With the passage of the Chesapeake Bay Restoration Act of 2000, Congress reauthorized the Chesapeake Bay Program to continue leading the restoration effort.

To help meet the goals of the Chesapeake Bay Agreement, fifteen federal agency partners of the Chesapeake Bay Program have signed a formal agreement to enhance stewardship on federally-managed land. The *Federal Agencies' Chesapeake Ecosystem Unified Plan* (Chesapeake Bay Program 1998) incorporates the Chesapeake Bay Program's directives on nutrient reduction, habitat restoration, wetlands, riparian forest buffers, and local government participation into a plan for the various federal agencies to meet the goals of the Chesapeake Bay Agreement.

The National Park Service is a signatory of the plan and is charged with increasing public access to the Chesapeake Bay by opening or enhancing access to at least 200 additional miles of federally-owned shoreline and tidal waters by 2005 and participating in the development of water trails and appreciation of the Bay and its resources.

Further, the plan calls for conservation and restoration of riparian forest buffers and stream corridors on federal lands by encouraging a stream assessment and inventory protocol and restoration of 200 miles of riparian buffers on federal lands by 2010. The NPS's riparian buffer plan calls for conservation of stream and shoreline buffers and, more specifically, restoration of 35 miles of streams and shoreline buffers in the Chesapeake Bay watershed by 2010. Riparian buffers should be at least 100 feet wide to adequately protect water quality in streams.

In addition, the Virginia General Assembly adopted the Chesapeake Bay Preservation Act in 1988. The act, a cooperative program between state and local governments, generally requires that land be managed in a way that the amount of pollutants entering the Bay be reduced by 40% before the year 2000. Specifically, the act (Chapter 21 Section 10.1-2100) requires that the counties, towns, and cities of Tidewater Virginia:

- Incorporate general water quality protection measures into their comprehensive plans, zoning ordinances, and subdivision ordinances;
- Establish programs that define and protect certain lands, Chesapeake Bay Preservation Areas, which if improperly developed may result in substantial damage to the water quality of the Chesapeake Bay and its tributaries; and
- Have access to financial and technical assistance, policy guidance, and oversight when requested from the Commonwealth.

The act also provides for state consistency: All agencies of the Commonwealth will exercise their delegated authority in a manner consistent with water quality protection provisions of local comprehensive plans and zoning and subdivision ordinances. Staffs from the Virginia Department of Conservation and Recreation (VDCR), the Department of Environmental Quality (VDEQ), Chesapeake Bay Local Assistance Department (CBLAD), and other natural resource agencies are working with localities and local interests to assess conditions, including ongoing activities to reduce pollution.

To provide direction for local governments in evaluating ecological and geological features in the context of the Chesapeake Bay ecosystem, the Chesapeake Bay Preservation Area (CBPA) designation is described in the Chesapeake Bay Preservation Act regulations (9VAC10-20). CBPAs are divided into Resource Protection Areas (RPAs) and Resource Management Areas (RMAs).

Resource Protection Areas consist of "sensitive lands at or near the shoreline that have intrinsic water quality value due to the ecological and biological processes they perform or are sensitive to impacts which may cause significant degradation to the quality of state waters." These lands provide for the removal, reduction, or assimilation of

sediments, nutrients, and potentially harmful or toxic substances in runoff entering the Bay and its tributaries, and minimize the adverse effects of human activities on state waters and aquatic resources. RPAs include tidal wetlands, tidal shores, nontidal wetlands connected by surface flow and contiguous to tidal wetlands or tributary streams, and an adjacent 100-foot buffer area.

Resource Management Areas are “land types that, if improperly used or developed, have a potential for causing significant water quality degradation or for diminishing the functional value of the Resource Protection Area.” An RMA will be established contiguous to the entire inland boundary of the RPA, and will include floodplains, highly erodible soils, steep slopes, highly permeable soils, nontidal wetlands not included in the RPA, and other areas deemed necessary in the protection of the state’s water quality.

The James City County Chesapeake Bay Preservation Ordinance (Ord. No.183, 8-6-90) designates all of James City County as a Chesapeake Bay Preservation Area. Therefore, RPAs consist of areas as defined by the Chesapeake Bay Preservation Act, while all other areas within the county are considered RMAs. The ordinance provides guidelines for development within either of these areas and strives to control and regulate runoff to minimize pollution and deposition of sediment in wetlands, streams, and lakes.

In particular, the ordinance specifies that development within the RPA may be allowed only if it is water dependent or constitutes redevelopment; that indigenous vegetation throughout the CBPA should be preserved to the maximum extent possible, including existing trees over 12 inches in diameter at breast height; stormwater runoff should be controlled by the use of BMPs so that the post-development non-point source pollution runoff load does not exceed the predevelopment load; and all wetlands permits required by federal, state, or county laws and

regulations should be obtained before initiated grading or other onsite activities. In addition, any land-disturbing activity exceeding 2,500 square feet in the CBPA will require a plan of development process, including site and subdivision plans, an environmental inventory, a clearing plan, a stormwater management plan, an erosion and sediment control plan, and a landscaping plan. The final site plans must include delineation of the RPA boundary, delineation of required buffer areas, delineation of RMA wetlands, all wetlands permits required by law, delineation of slopes 25% or greater, and a BMP maintenance agreement to ensure proper maintenance of BMPs in order to continue their functions.

Using the general RPA/RMA map provided by James City County and the known delineated wetlands at the site, the actual RPA boundaries within the Jamestown Project site were delineated (Figure 3-11). In addition, dominant trees within RPAs potentially impacted by the Jamestown Project were observed and measured (diameter at breast height or DBH).

At Neck of Land, the lowland pine/oak forest is the dominant cover type found within the RPA, although a large stand of invasive bamboo (*Arundinaria gigantea*) covers an area adjacent to the old foundations north of the Old Route 31 road trace. The canopy layer includes sweetgum (*Liquidambar styraciflua*), red maple (*Acer rubra*), white ash (*Fraxinus americana*), and loblolly pine (*Pinus taeda*). The average DBH of most understory trees was less than 12 inches. Interspersed among these smaller trees and the bamboo thicket are individual mature oaks averaging 35 inches DBH, and mature loblollies averaging 26 inches DBH. Except for the southern protrusion of the eastern edge of Neck of Land, there are very few seedling loblollies found. At higher elevations, red oak (*Quercus rubra*), white oak (*Quercus alba*), black oak (*Quercus velutina*), and hackberry (*Celtis occidentalis*) can be found. The oaks averaged 30 inches DBH, and the hackberries averaged 14 inches DBH. There

is a predominant understory concentration of American holly (*Ilex opaca*) at the northeastern edge of Neck of Land. Dogwood (*Cornus florida*) and black cherry (*Prunus serotina*) are found in the understory layer along the old roadbed and at the eastern edge of the terrace. The average DBH for both species was less than 12 inches.

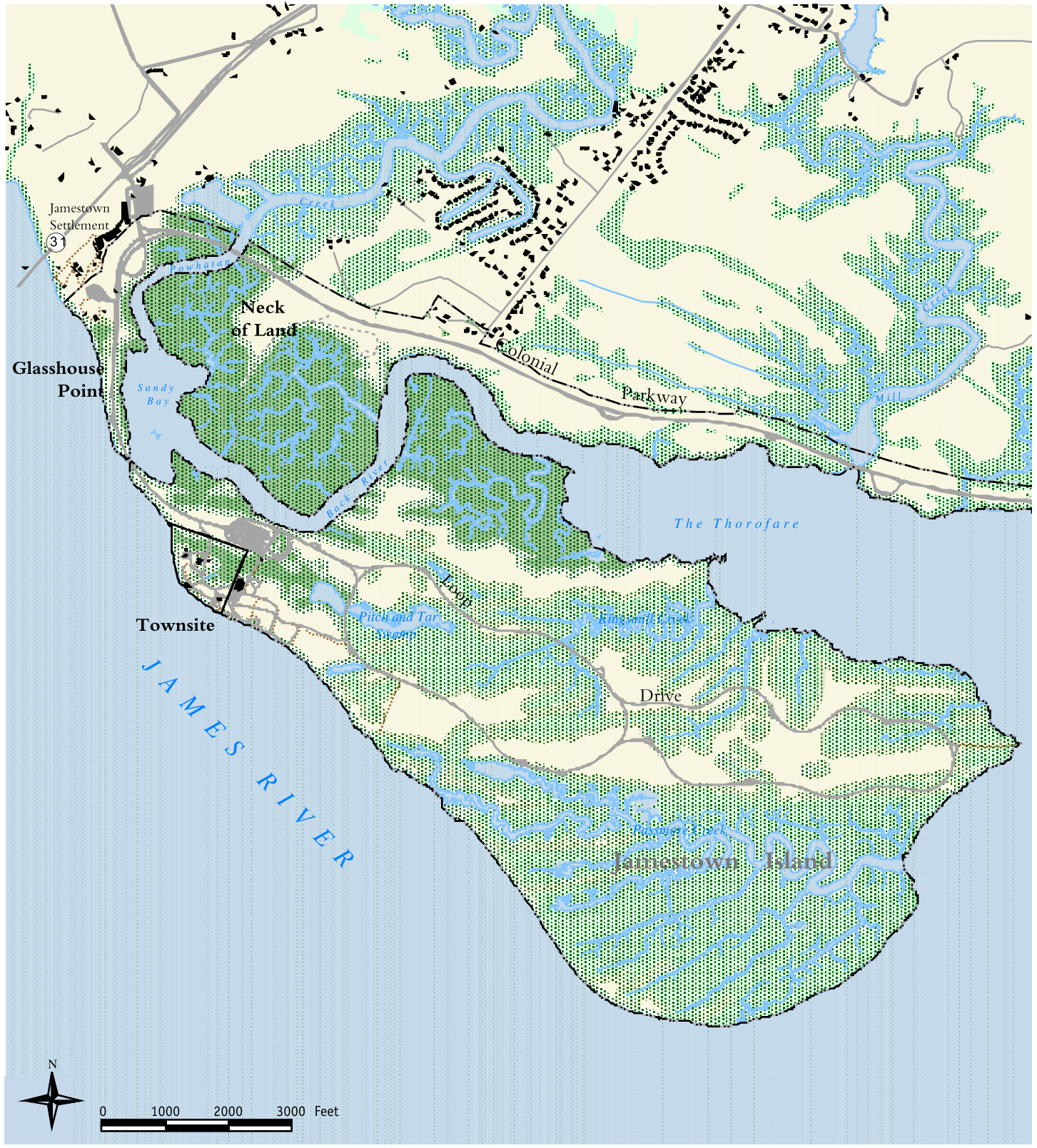
The Pitch and Tar Swamp located between the Visitor Center parking lot and the historic core area contains a number of vegetative communities. The tidal hardwood and estuarine fringe pine forests define the southern edge of the swamp between the Visitor Center and the seawall. The northern edge along the footbridge is a tidal freshwater marsh community. The remaining RPA zone between the northern edge of the swamp and the Visitor Center parking lot is a mesic mixed hardwood forest buffer. Trees accessible on dry land were individually measured. Those located within a wet or deep mud area were estimated by eye based on comparable trees measured nearby.

Loblolly pine (*Pinus taeda*) dominates all communities, having an average DBH of approximately 18 inches. This species makes up 50% of the total tree population over 12 inches DBH within the RPA. Red maple is the next most dominant overstory species, although it comprises only 7% of the total tree population over 12 inches DBH. A small stand of nine American cypress trees (*Taxodium distichum*) exists at the far western edge of the swamp by the seawall. Their average DBH is about 18 inches. Eastern red cedar (*Juniperus virginiana*), black gum (*Nyssa sylvatica*), pecan (*Carya illinoensis*), and hackberry (*Celtis occidentalis*) are found in equal amounts throughout the area. The average DBH for the cedar is roughly 15 inches, while the black gum about 15, the pecan approximately 14, and the hackberry about 14 inches. Other overstory species like American sweetgum (*Liquidambar styraciflua*), American elm (*Ulmus americana*), green ash (*Fraxinus pennsylvanica*), willow oak (*Quercus phellos*), boxelder (*Acer negundo*) and American sycamore

(*Platanus occidentalis*) are interspersed throughout the various communities. Approximate average DBH for the species follow: 15 inches for both the sweetgum and elm, 14 for the ash, 14 for the willow oak, 15 for the boxelder, and 14 inches for the sycamore. A single common persimmon (*Diospyrus virginiana*) and northern red oak (*Quercus rubra*) were also found. They have a DBH of 12 and 16, respectively.

Within the riparian buffer zone along the small pond at the eastern edge of New Towne, loblolly pine dominates, populating up to 68% of total tree cover with DBH over 12 inches. The average DBH for this species is roughly 20 inches. The next most dominant species is the pecan, with an average DBH of 17 inches. The canopy layer includes red oak (DBH of 26 inches), isolated mature southern red oaks (27 inches), tulip poplar (29.5 inches), northern pin oak (40 inches), post oak (13 inches), and willow oak (13.5 inches). In addition, isolated findings of small canopy trees, such as black cherry (40 inches), black locust (19 inches), and persimmon (18.5 inches) were also observed. Eastern red cedar (17 inches) and bald cypress (28 inches) complete the species composition for this area.

A survey was also taken along the strip of land located between the Back River marsh and the northern edge of the parking lot exit drive. Trees were identified between the Loop Drive entrance and the curve of the parking lot. Loblolly pine dominates this mesic mixed hardwood forest. This species represents 80% of the total tree population over 12 inches DBH. Average DBH for this species is 17.2 inches. Overstory species such as the American sweetgum, willow oak, cherrybark oak (*Quercus falcata* var. *pagodaefolia*), and pecan are interspersed in this area. All have fairly large DBH averages: the sweetgum is 16 inches, willow oak is 21, cherrybark oak is 20, and the pecan is 21 inches. The understory population consists of eastern red cedar, black gum, common persimmon, and a single black locust (*Robinia pseudoacacia*). The black gum and persimmon DBH are 14, the black locust is 15, and the eastern red cedar is 13 inches.

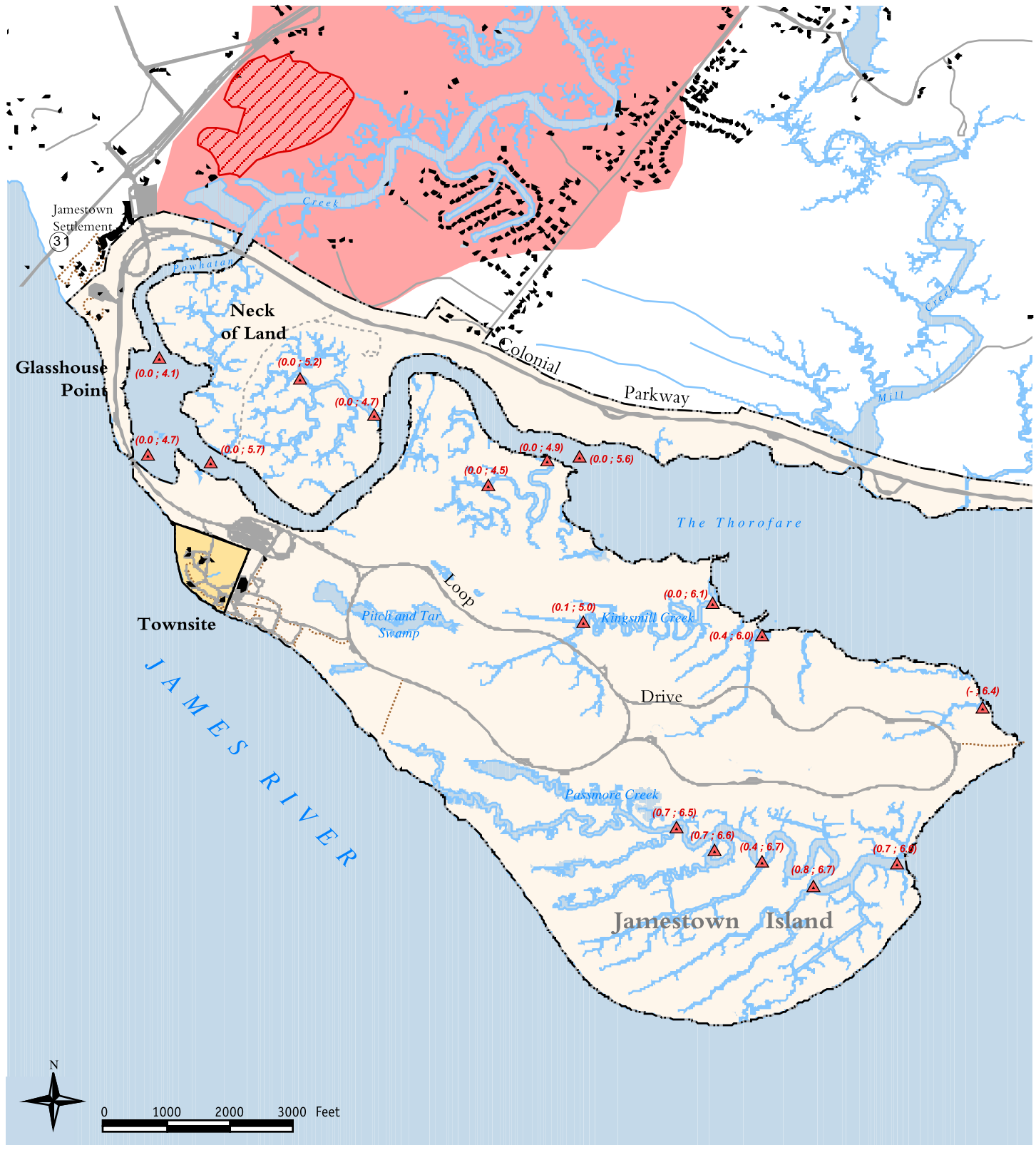


Legend

- Wetlands - Delineated
- Wetlands - Other
- Resource Protection Area & 100' Buffer
- Resource Management Area

Figure 3-11: Chesapeake Bay Resource Protection (RPA) and Management Areas (RMA)

RPA/RMA boundaries were determined using James City County designations and known wetland information.



Legend

- ▲ Approximate water sample location (Depth = 1 Foot)
- (0.7; 6.6) (Salinity Level May 1991 ; Salinity Level October 1991)
- Colonial National Historical Park
- Association for the Preservation of Virginia Antiquities
- Powhatan Creek Watershed (Ecologically Sensitive)
- Priority Conservation Area

Figure 3-12: Waterways

3.3.2.5 Surface Waters

Several tidally influenced waterways and their associated wetlands cover a large portion of the Jamestown Project site (Figure 3-12). The James River borders the site to the west, south, and east. At Jamestown Island, the James River is wide and sluggish and resembles a bay and estuary system because the river maintains an average water elevation near sea level.

In addition, Powhatan Creek flows onto the site from the north and empties into the James River via the Sandy Bay, Back River, and The Thorofare system. This system divides Jamestown Island from Neck of Land and Glasshouse Point. The southern portion of the Island is mainly composed of Passmore Creek and several of its tributaries, which drain eastward toward the James River. In addition, the Pitch and Tar Swamp, located on the Island, feeds Kingsmill Creek, which flows into The Thorofare. Salinities of these surface waters are listed in Table 3-8.

| Table 3-8: Salinity of Surface Waters | |
|---------------------------------------|--------------------|
| Surface Water | Salinity* (ppt) |
| Sandy Bay | 0.0, 4.7 |
| Powhatan Creek | 0.0, 4.1 |
| The Thorofare | 0.0, 6.0 |
| Back River | 0.0, 5.1 |
| Passmore Creek | 0.7, 6.6 |
| Kingsmill Creek | 0.0, 5.5 |

*Note: sampled May, September 1991 at depth 1 foot

Overall, the James River is 450 miles long with a watershed covering 10,432 square miles, one-fourth of the state's land base. Except for a small drainage area in West Virginia, the James River watershed is located almost entirely within Virginia. Land use in the river's basin varies considerably from its headwaters to its mouth. Overall, about 71% of the land is forested, 23% is agricultural, and 6% is urban. Major urban areas include the Hampton Roads complex and the Richmond metropolitan area.

The Jamestown Project site lies within the Lower James River-Middle Tidal watershed (the portion of the James River watershed containing the project site), which covers 142 square miles and includes Colonial Williamsburg, James City County, and Surry County. Cover within the watershed consists mainly of forested areas (approximately 45%), with 0% to 7% being impervious.

The Powhatan Creek subwatershed (of the James) is located primarily in James City County, covers 22 square miles, and drains to the James River near Jamestown Island. It is designated by the Virginia Department of Conservation and Recreation's Division of Natural Heritage (VDNH) as one of the most significant natural areas remaining on the Lower Peninsula, and approximately 35% of the total watershed has been designated by the Center for Watershed Protection (CWP) as priority conservation areas (CWP 2001 and Sturm 2001). Because the watershed is technically adjacent to the Jamestown Project site, no conservation areas have been identified within the project area; however, the conservation area closest to the Jamestown Project site is located north of the Jamestown Marina (Figure 3-12). It is a contiguous forest tract approximately 60 acres in size. Where Powhatan Creek flows into the James River, the watershed is tidally influenced. This tidal portion extends from the northern border of the Jamestown Project site to the crossing at Route 5 and covers 2.5 square miles.

Shoreline

In 1999, the Virginia Institute of Marine Science (VIMS) prepared the *Shoreline Management Plan for Jamestown Island, Powhatan Creek, Sandy Bay, Back River, The Thorofare, and James River Shorelines* for Colonial NHP. The management plan addresses the desire of federal and state agencies to "develop cooperative projects to improve water quality and enhance wetland habitat in the Chesapeake Bay region, while preventing the loss of significant resources, particularly those archeological sites near the water's edge" (Hardaway et al. 1999).

The objectives of the *Shoreline Management Plan* include:

- Prevention of loss of land and protection of uplands;
- Protection, maintenance, enhancement, and/or creation of wetlands habitat, both vegetated and nonvegetated;
- Management of upland runoff and groundwater flow through vegetated wetland fringes;
- Addressing potential secondary impacts within the reach of a proposed shoreline strategy, which may include impacts to downdraft shores through a reduction in the sand supply or the encroachment of structures onto subaqueous land and wetlands;
- Provision of access and/or creation of recreational opportunities such as beach areas;
- Development of a shoreline strategy that does not interfere with historical interpretation.

In undertaking development of the property according to the *Shoreline Management Plan*, all shorelines and nearshore characteristics surrounding NPS property on and around Jamestown Island were analyzed for historic erosion trends, wave climate, and adjacent land use. The plan ranked shorelines by division into three types of areas of concern:

- Lesser Areas of Concern (LAOC) – include eroding upland areas with no archaeological sites or eroding marsh sites that are very near breaching, which then would expose the adjacent upland to more frequent wave activity.

- Areas of Concern (AOC) – include eroding shorelines that threaten infrastructure and/or archaeological resources.
- Critical Areas of Concern (CAOC) – include areas where sensitive archaeological resources are threatened by erosion, generally on the uplands and ridges around Jamestown Island.

Numerous shoreline structures, such as stone revetments and seawalls, have been installed over the years to protect uplands from erosion, but the unprotected shorelines continue to erode. The total length of shoreline included in the VIMS study is about 14.6 miles.

Shoreline erosion rates along estuarine shorelines are a function of two unrelated factors – hydrodynamic forcing and the site-specific character of the sediments. The highest rates of erosion occur during storms in response to storm surges and winds. Given equal exposure to waves and currents, shores consisting of medium- and fine-grained sands will erode more rapidly than deposits of clays or silts, which exist in lagoonal, estuarine, or marsh deposits. For example, along the Jamestown Island shore on The Thorofare, the low upland banks, or ridges, tend to erode faster than the adjacent marsh (swale) shorelines. Due to this differential erosion potential, the marshes have become headland features.

Generally, there are four important bank/shore types around Jamestown Island and along the Colonial Parkway: beaches/spits, upland banks, marsh fringe, and protected shorelines. The shoreline along Jamestown Island on the James River is composed of eroding marsh and upland banks. Shoreline armoring has protected much of the upriver section of this shoreline. These structures include a sloped concrete seawall at the original James Fort area and a stone revetment 2,000 feet downstream.

The shoreline fronting Glasshouse Point is a low, upland bank with a narrow beach along much of its length that is routinely overtopped during storms. A low, stone revetment has been built at the base of the upland bank and is intermittently covered by a beach. The ruins of the original Glasshouse occur in the upland region, and a potential threat exists from flooding during severe storms with high surges. A narrow beach occurs in front of a low revetment just east of this area.

The shoreline along the isthmus and the APVA property is upland or fill (from the creation of the isthmus). Stone revetments protect the isthmus shoreline; however, the stones appear to have settled, allowing tidal encroachment and subsequent creation of a tidal marsh. Along the APVA property, the average shoreline erosion rate has been reduced to near zero since the construction of a sloped, concrete wall by the COE in 1900. The seawall has been maintained by the COE; however, as with other structures along this reach, it warrants assessment and monitoring to ensure long-term stability.

Downriver on the James, along New Towne and Lower Point, the shoreline has advanced due to accretion of sediments. The position of the 1945/55 shoreline is an average of 100 feet seaward of the 1874 shoreline. The shore is both upland and marsh along this reach, and it appears that recently the beach has been eroding. There are also several low stone revetments along this area. The stone revetment at New Towne is being evaluated by the COE, and plans include adding armor stone and raising the crest elevation of the structure.

The remaining shoreline along Jamestown Island's southeastern shore is unprotected and eroding but becomes more stable with a widened beach toward Lower Point. The long-term plan includes breakwaters and spurs strategically placed along the entire shore in order to begin the process of headland control. Combined with new wetland establishment, the system proposed along the beach-fronted ridge and swale system provides for

low reef headland breakwater placement in front of each ridge to allow equilibrium embayments to form in the swales or marsh areas.

The southeast end of the Island shoreline experienced periods of advance (when the shoreline grew due to deposit of new material) from 1942 to 1952 and 1979 to 1983 that may have been influenced by the disposal of dredge material. Shore retreat increased significantly in other areas between 1979-83 and 1990, especially at Black Point, which has a net erosion rate of 1.5 feet per year (Hardaway et al. 1999). Marsh shoreline is located along the mouth of Passmore Creek, and a low revetment has protected upland areas on the south side of Black Point adjacent to this marsh. Black Point is the leading headland feature on the eastern end of Jamestown Island. Suggested improvements here include a low sill with wetland plantings and an opening at Black Point for views of the James River.

Shorelines located along the Powhatan Creek, Sandy Bay, Back River, and The Thorofare have had little or no shore protection, except for the north side of the isthmus in Sandy Bay where a bulkhead was built. Most of these shorelines show signs of erosion, and several Areas of Concern occur along the upland areas between marsh drainages. Vertically exposed eroding upland banks are considered significant in the presence of threatened infrastructure and/or cultural resources. These banks and marsh headlands are the primary targets of the *Shoreline Management Plan* for these reaches. Stone revetments would certainly halt the erosion of these features, but offshore sills with a sand substrate would allow the establishment of a marsh fringe, which is preferred in terms of aesthetics and creation of estuarine habitat.

The Jamestown Island shoreline along The Thorofare is primarily eroding marsh and low, upland banks. Along the north side of The Thorofare, there has been shoreline advance over the past century, probably a result of filling of the shore zone for construction of the Colonial Parkway. These fill areas created high upland areas from marsh and river bottom by raising

the elevation by 10 feet or more. The only beach area occurs in front of the eroding upland banks. Both sides of the entrance to Mill Creek are stabilized with low, stone revetments. Management strategies for shorelines on both sides of The Thorofare include a combination of sills, spurs, and breakwaters that are designed to protect archaeological sites on Jamestown Island and enhance existing headland features along the Colonial Parkway shoreline. These reaches are in a low- to moderate- energy wave climate, and there are numerous small pocket beaches.

Nearshore Environment

Along the James River shoreline, the nearshore shelf from the shoreline to the -12-foot mean low water (MLW) isobath varies in width from 500 feet east of Black Point to 100 feet off Lower Point to 400 feet off Church Point and the Townsite. The nearshore region along the James at Glasshouse Point and the isthmus is wide, with the 12-foot contour about 1,400 feet offshore. An old marsh island now forms a small shoal that contributes to wave modification and influences the movement of sand along the shore. Because the 12-foot contour comes to within 300 feet of the shore off Church Point and old Jamestown, several old wharfs are located offshore here. The 12-foot contour is less than 100 feet offshore at Lower Point but extends offshore from the mouth of Passmore Creek to about 2,000 feet and is 3,000 feet off Black Point.

The Thorofare has a maximum depth of 6 feet, which occurs in a narrow channel into the Back River. The Back River averages about 200 feet wide with narrow nearshore regions that drop quickly into the wide tidal channel, which reaches depths of 18 feet around Pyping Point but averages 8 to 9 feet. Back River becomes Sandy Bay to the northwest. Sandy Bay is about 1,000 feet wide at its widest point with depths averaging 5 feet. A narrow channel through the isthmus connects Sandy Bay to the James River. The Bay narrows into Powhatan Creek, which turns north and flows under the Colonial Parkway. Powhatan Creek averages 100 feet wide, has a very narrow nearshore, and has an average depth of 5 feet.

Benthic Community

Generally, there are no significant marine resources, such as oysters or clams, in the nearshore within the project area because anthropogenic impacts to the nearshore region have been significant. These impacts include the construction of the Jamestown Isthmus and Colonial Parkway, dredging and disposal of sediment, and building of structures upriver from Jamestown Island, which restrict the sediment supply.

Benthic refers to aquatic organisms that are found with or on the bottom sediments. Numerous benthic surveys have been conducted in the Hampton Roads area, including the James River and vicinity (Boesch 1971; Boesch 1973; Diaz 1989). The substrate in this area is generally high in numbers of individual organisms, but low in community diversity.

There are no public or privately leased oyster grounds in the vicinity of Jamestown Island. The closest oyster grounds are located downriver, approximately 14 miles.

Micro- and macro-organisms in the planktonic community are numerous and include diatoms, dinoflagellates, foraminifera, skeleton shrimp, jellyfish, stinging nettles, and larval forms of fish, crustaceans and other organisms. Animal benthos known to inhabit the Jamestown Project area include the barnacle (*Balanus sp.*), spider crab (*Libinia sp.*), hermit crab (*Pagurus sp.*), blue crab (*Callinectes sapidus*), starfish (*Asterias sp.*), slipper shell (*Crepidula sp.*), mud snail (*Nassarius sp.*) and oyster drill (*Urosalpinx sp.*).

Submerged Aquatic Vegetation

The predominant form of submerged aquatic vegetation (SAV) in the more saline portions of tidal tributaries of the Chesapeake Bay is eel grass (*Zostera marina*), which grows in dense patches on the benthos in the depth zone where light penetration is good. The Virginia Institute of Marine Science conducts annual surveys of SAV in

the Chesapeake Bay and its tributaries, including the James River. Since the baywide survey began in 1978, and until 1995, only one bed had been mapped in the mainstem of the James, at the mouth of Hampton River. This bed persisted and increased to four beds by 1996; and a fifth bed was mapped east of the Hampton Bridge in 1997. The Upper and Middle James River had no SAV mapped in 1997 (Orth et al 1998). In 1998, a fringing bed was discovered at the mouth of Mill Creek on the north side of the Thorofare near Jamestown Island; however, no SAV was observed in 2000 (Orth et al. 2000) in the vicinity of Jamestown Island. In fact, the area of SAV in the Upper and Middle James decreased by 25% and 36%, respectively, between 1998 and 2000. The overall lack of SAV in this reach is probably related to high concentrations of suspended sediments in the water, which prevents sufficient light penetration.

Hydrodynamic Setting

Wind and Wave Climate

The entire Colonial NHP shoreline along the James River is subject to wind-driven wave forces that cause moderate to severe shoreline erosion. Storm activity, in particular over the past several years (i.e. Hurricane Gordon in 1994, Hurricanes Bertha and Fran in 1996, the Twin Nor'easters and Hurricane Bonnie in 1998), has eroded the shoreline along the river.

The *Shoreline Management Plan for Jamestown Island* (Hardaway et al. 1999) contains a detailed description of the wave climate at Jamestown Island. Because waves impacting the shore in the project area are wind driven, the general wave climate was quantified by first evaluating the local wind climate using a long-term wind data set for Norfolk International Airport (Table 3-9). A general wind field evaluation was used to model wave conditions on the James River. Offshore wind and wave directions are assumed to be the same to a point; however, the waves enter the nearshore shoaling region at the -15 feet MLW isobath. At this point, wave direction must be evaluated using a

wave refraction model such as the COE's RCPWAVE, which accounts for wave attenuation and refraction across the nearshore and shoreline.

The shoreline from Glasshouse Point to Church Point is open to the James River and has been exposed to winds and waves from the northwest, west, southwest, and south with fetches of 3.4, 3.1, 1.2, and 2.2 nautical miles, respectively. Table 3-10 (from Hardaway et al. 1999) shows the frequency (in number of occurrences) of each wind speed from each direction and the corresponding net transport values for the 30 years of wind data (in cubic yards, or cy, per 30 years). Positive transport is upriver; negative transport is downriver. Individual storms have not been included. Hardaway et al. conclude a net movement of sands alongshore in an upriver direction at a rate of 16 cy/yr. The exceptions are northwest storm conditions (46 mph), which drive sediment downriver; however, these are infrequent events. The average conditions from the south and southwest dominate the overall littoral transport system.

The James River shoreline between Church Point and Lower Point has fetches of 2.5, 3.1, 1.2, and 1.9 nautical miles to the northwest, west, southwest, and south. The southwest component has the highest frequency of impact on this shore. The shoreline and beach features indicate wave impact in the downriver direction, except at the southern end of the island where there appears to be no net littoral movement (Table 3-11). Net movement along the length of this stretch is 1 cy/yr, which Hardaway et al. conclude to be insignificant and representative of the balanced movement of beach sands.

The shoreline at the southern end of Jamestown Island from Lower Point to Black Point is exposed to wind/wave action from the east, southeast, and south with fetches of 2.4, 1.8, and 2.2 nautical miles. The number of occurrences for the southerly wind direction is most common (Table 3-12). Wave climate analysis results find no net alongshore transport; however, the presence of historic and ongoing erosion in this area suggests onshore-offshore movement of sediments.

**Table 3-9: Summary of Wind Conditions at Norfolk International Airport from 1960 to 1990
(from Hardaway et al. 1999)**

| Wind Speed (mph) | Wind Direction | | | | | | | | Total |
|------------------|----------------|-----------|--------|-----------|--------|-----------|--------|-----------|---------|
| | South | Southwest | West | Northwest | North | Northeast | East | Southeast | |
| <5 | 5,497* | 3,316 | 2,156 | 1,221 | 35,748 | 2,050 | 3,611 | 2,995 | 56,594 |
| | 2.12% | 1.28% | 0.82% | 0.47% | 13.78% | 0.79% | 1.39% | 1.15% | 21.81% |
| 5-11 | 21,083 | 15,229 | 9,260 | 6,432 | 11,019 | 13,139 | 9,957 | 9,195 | 95,314 |
| | 8.13% | 5.87% | 3.57% | 2.48% | 4.25% | 5.06% | 3.84% | 3.54% | 36.74% |
| 11-21 | 14,790 | 17,834 | 10,966 | 8,404 | 21,816 | 16,736 | 5,720 | 4,306 | 100,572 |
| | 5.70% | 6.87% | 4.23% | 3.24% | 8.41% | 6.45% | 2.20% | 1.66% | 38.77% |
| 21-31 | 594 | 994 | 896 | 751 | 1,941 | 1,103 | 148 | 60 | 6,487 |
| | 0.23% | 0.38% | 0.35% | 0.29% | 0.75% | 0.43% | 0.06% | 0.02% | 2.5% |
| 31-41 | 25 | 73 | 46 | 25 | 162 | 101 | 10 | 8 | 450 |
| | 0.01% | 0.03% | 0.02% | 0.01% | 0.06% | 0.04% | 0.00% | 0.00% | 0.17% |
| 41-51 | 0 | 0 | 0 | 1 | 4 | 4 | 1 | 0 | 10 |
| | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| Total | 41,989 | 37,446 | 23,324 | 16,834 | 70,690 | 33,133 | 19,447 | 16,564 | 259,427 |
| | 16.19% | 14.13% | 8.99% | 6.48% | 27.25% | 12.77% | 7.50% | 6.38% | 100.00% |

Note: *Number of occurrences

**Table 3-10: Wind/Wave Frequency with Associated Littoral Transport for James River – Glasshouse Point to Church Point
(from Hardaway et al. 1999)**

| Wind Speed (mph) | Northwest | | North | | Southwest | | South | | Total Mean-Weigh | |
|------------------|-----------------|---------------|-----------------|---------------|-----------------|---------------|-----------------|---------------|------------------|---------------|
| | Net cy/ 30 yrs. | No. of Occur. | Net cy/ 30 yrs. | No. of Occur. | Net cy/ 30 yrs. | No. of Occur. | Net cy/ 30 yrs. | No. of Occur. | Net cy/ 30 yrs. | No. of Occur. |
| 16 | -5,806 | 8,404 | -1,564 | 10,966 | 953 | 17,834 | 6,199 | 14,790 | 822 | 51,994 |
| 26 | -11,721 | 751 | -7,658 | 896 | -702 | 994 | 552 | 594 | -4,956 | 3,235 |
| 36 | -14,336 | 25 | -11,832 | 46 | 3,763 | 73 | 12,780 | 25 | -1,825 | 169 |
| 46 | -53,294 | 1 | -43,385 | 0 | 17,702 | 0 | 82,180 | 0 | -53,294 | 1 |

Note: cy=cubic yards

Table 3-11: Wind/Wave Frequency with Associated Littoral Transport for James River – Church Point to Lower Point (from Hardaway et al. 1999)

| Wind Speed (mph) | Northwest | | North | | Southwest | | South | | Total Mean-Weigh | |
|------------------|-----------------|---------------|-----------------|---------------|-----------------|---------------|-----------------|---------------|------------------|---------------|
| | Net cy/ 30 yrs. | No. of Occur. | Net cy/ 30 yrs. | No. of Occur. | Net cy/ 30 yrs. | No. of Occur. | Net cy/ 30 yrs. | No. of Occur. | Net cy/ 30 yrs. | No. of Occur. |
| 16 | -219 | 8,404 | -208 | 10,966 | 28 | 17,834 | 485 | 14,790 | 68 | 51,994 |
| 26 | -3,255 | 751 | -558 | 896 | 364 | 994 | 856 | 594 | -641 | 3,235 |
| 36 | -644 | 25 | -12,990 | 46 | 2,166 | 73 | 21,330 | 25 | 460 | 169 |
| 46 | 0 | 1 | -61,184 | 0 | -2,687 | 0 | 78,658 | 0 | 0 | 1 |

Note: cy=cubic yards

Table 3-12: Wind/Wave Frequency with Associated Littoral Transport for James River – Lower Point to Black Point (from Hardaway et al. 1999)

| Wind Speed (mph) | East | | Southeast | | South | | Total Mean-Weigh | |
|------------------|-----------------|---------------|-----------------|---------------|-----------------|---------------|------------------|---------------|
| | Net cy/ 30 yrs. | No. of Occur. | Net cy/ 30 yrs. | No. of Occur. | Net cy/ 30 yrs. | No. of Occur. | Net cy/ 30 yrs. | No. of Occur. |
| 16 | 396 | 5,720 | 175 | 4,306 | -184 | 14,790 | 12 | 24,816 |
| 26 | 1,044 | 148 | 1,005 | 60 | -696 | 594 | -248 | 802 |
| 36 | 16,578 | 10 | 12,454 | 8 | -16,877 | 25 | -3,640 | 43 |
| 46 | 51,596 | 1 | 17,979 | 0 | -45,569 | 0 | 51,596 | 1 |

Note: cy=cubic yards

The shoreline along the north shore of Jamestown Island borders The Thorofare and faces north. It is impacted most by the northeast, north, and northwest wind fields. There is little movement of sand along this reach, but some erosion to banks and beaches suggests a movement of sediment downriver in response to northwesterly winds/waves.

The shorelines along Powhatan Creek, Sandy Bay, and Back River are fetch-limited (they are not wide enough for winds to play a major part in wave action and erosion), but tidal currents and boat wakes can exacerbate shoreline erosion.

Sea-Level Rise

During the Tertiary Period, shallow seas covered the Coastal Plain for long periods of time. Jamestown

Island was built upon muddy sand in a shallow sea that spread westward beyond what is now Richmond about 7 million years ago. Subsequently, sea level fell, and the Coastal Plain became emergent. This pattern of the Coastal Plain being intermittently flooded and exposed repeated several times during the Miocene, Pliocene, and Pleistocene, as large continental glaciers formed and retreated. The courses of the major Coastal Plain Rivers, including the James and its tributaries, were established in the late Pliocene or early Pleistocene.

During the most recent glaciation (glacial maximum 18,000 years ago), sea level fell to more than 100 feet below its present level, and rivers and streams, including the James River and Powhatan and Passmore Creeks downcut, producing deepening valleys. As the glaciers later melted, sea level began

to rise, and by 10,000 years ago, sea level had risen to about 100 feet below present. By 5,000 years ago, sea-level rise had slowed, and the entire lower Chesapeake Bay area was flooded, creating the modern estuary and its tributaries. Approximately 2,500 years ago, sea level was 8 to 10 feet lower than present, and the James River was narrower. Generally over the past 1,000 years, sea level change in the Chesapeake Bay region has been slow, rising less than 2.2 inches per 100 years. The slow rise in sea level continued until about 1850, when data indicate a sharp increase in sea-level rise.

In Hampton Roads between 1927 and 1980, the yearly mean of sea level increased approximately 1.6 inches per decade or 16 inches per century (Hardaway et al. 1999). This increase could be the result of one or more of a number of factors, including global fluctuations in sea level from the growth and melting of continental glaciers and large-scale changes in the configuration of continental margins and ocean floors, or regional processes such as thermal expansion of ocean waters, changes in meltwater load, crustal rebound from glaciation, uplift or subsidence related to tectonics, fluid removal, and sediment deposition and compaction. Fluctuations in the angular velocity of the Earth or polar drift may also cause variations in relative sea level.

In the Chesapeake Bay region, scientists believe that global warming and thermal expansion account for about 6 inches of the sea-level rise that has occurred in the past 100 years (EPA 2001). Natural geologic subsidence of land, possibly exacerbated by the compaction of sediments as people withdraw groundwater, has probably contributed to the remaining sea-level rise. EPA (2001) estimates that with additional global warming and continued subsidence, sea level in the Chesapeake Bay region will rise an additional 8 inches by 2025, 13 inches by 2050, and 27 inches by 2100, compared with the level in 1990. This represents a rate of sea-level rise double that of the preceding century.

Increases in relative sea level (position and height of the sea relative to the land) may alter the position and morphology of the coastline and cause coastal flooding, waterlogging of soils and a loss of land. Coastal wetlands and salt marshes may be destroyed, and coastal settlements may be inundated. Additionally, aquifers may experience saltwater intrusion, leading to salinization of groundwater.

Tides

The tides affecting Jamestown are semi-diurnal, consisting of two high tides and two low tides each day. According to the Norfolk District of the Corps of Engineers (2000), the closest National Oceanic and Atmospheric Administration (NOAA) tidal station is southeast of Jamestown Island at the South Thimble Island of the Chesapeake Bay Bridge Tunnel. The mean tidal range is 2.60 feet with a spring tide range of 2.95 feet.

Tropical and Extra-tropical Storms

Since 1871, 123 hurricanes and tropical storms have affected Virginia, and the eye or center of 69 tropical cyclones has tracked directly across Virginia. Virginia averages tropical storm each year (Watson 2002) and a hurricane once every 2.3 years (Roth and Cobb 2002). The Saffir-Simpson Hurricane Damage Scale (Table 3-13) is used to classify hurricanes into five categories based on their strength. It is believed that scientifically, the strongest possible storm that could hit the Virginia coast is a Category 4 storm because the water temperatures off the coast are too cool to support a category five storm (Watson 2002).

| Table 3-13: Saffir-Simpson Hurricane Damage Scale | | |
|---|-----------------------|------------------|
| Hurricane Category | Sustained Winds (mph) | Damage Potential |
| 1 | 74-95 | Minimal |
| 2 | 96-110 | Moderate |
| 3 | 111-130 | Extensive |
| 4 | 131-155 | Extreme |
| 5 | >155 | Catastrophic |

In most cases tropical cyclones have moved across Virginia from southwest to northeast (Roth and Cobb 2002). The most common effect of a tropical cyclone passing by Virginia is its associated rainfall, which usually occurs to the east of the storm's track. In addition, storm surge and extra-high tides often occur in coastal areas.

Storm surge is the water that is pushed toward the shore by the force of winds swirling around major storm events, such as tropical hurricanes or nor'easters. This advancing surge combines with normal tides to create a storm tide. In addition, wind-driven waves are superimposed on this storm tide. The rise in water level can cause severe flooding in coastal areas, particularly when the storm tide coincides with the normal high tides.

Because the elevation is low at Jamestown Island, there is the potential for damage from storm surge flooding, and so tropical and extra-tropical storms affecting Virginia pose a threat to the Island. A number of hurricanes have impacted the Hampton Roads area in the past century (Table 3-14): Bonnie in 1998, Agnes in 1972, Hazel in October 1954, and unnamed hurricanes in 1933 and 1936. The 1933 storm was this century's storm of record, with a tide of 9.8 feet above mean lower low water (MLLW) at Norfolk.

The August 1933 storm was the last hurricane to make landfall in or near the Virginia coast, and damage throughout the Tidewater area was significant. At Yorktown, flooding was severe, as the tide reached an estimated 9.7 feet above MLLW (approximately 5 feet above the point where damage from flooding begins). West Point on the York River reported the highest tide of 10 feet above MLLW.

Historically, Virginia has endured a number of intense hurricanes and tropical storms. Of a September 6, 1667 storm, it was said that Jamestown saw 10,000 homes blown down (Watson 2002).

In addition to damaging tropical storms, extra-tropical storms (nor'easters) are possible from late fall through spring, and although not as powerful as hurricanes, the waves they generate can have greater wave heights because of the storm's long duration and large fetch. Winds around the storm's center can become intense, building waves that beat the coastline and pile water inland, causing extensive coastal flooding and beach erosion. In addition, the nor'easter can linger through several tides, each one piling more water on shore and into bays (Watson 2002). Nor'easters in April 1956 and March 1962 (the "Ash Wednesday Storm") created surges of 6.5 and 7.4 feet, respectively, above MSL at Norfolk (Milligan and Hardaway 1996).

Table 3-14: 20th Century Hurricanes in Virginia

| Storm | Description |
|------------------------------|--|
| Floyd September 6, 1999 | 6.8 inches of rain; largest peacetime evacuation in U.S. history |
| Dennis September 4, 1999 | 3.3 inches of rain; significant beach erosion |
| Bonnie August 27, 1998 | Tide 6.0 feet above MLLW; 4-7 inches of rain; most significant storm since 1960 |
| Fran September 5, 1996 | 0.2 inches of rain; passed west of area over Danville |
| Bertha July 13, 1996 | Tornados over Tidewater and Middle Peninsula |
| Charley August 17, 1986 | Tide 5.5 feet above MLLW |
| Gloria September 27, 1985 | Tide 5.3 feet above MLLW; 5.65 inches of rain |
| David September 5, 1979 | Tornados in Hampton and Newport News |
| Agnes June 21, 1972 | 13.6 inches of rain; James River crested at a record high in Richmond |
| Camille August 19, 1969 | 27 inches of rain, most in Nelson County; 153 people died |
| Cleo September 1, 1964 | Heaviest 24 hours of rain (11.4 inches) in coastal area since records began in 1871 |
| Hazel October 15, 1954 | Highest wind speed of record for Norfolk |
| September 18, 1936 | Tide 9.3 feet above MLLW; second highest tide of record |
| September 16, 1933 | Tide 8.3 feet above MLLW |
| August 23, 1933 | Tide 9.8 feet above MLLW – record high tide; last storm to make landfall in or near the Virginia coast |
| September 19, 1928 | Tide 7.16 feet above MLLW |
| October 10, 1903 | Tide 9 feet above MLLW |

Other notable storms of recent years include the “Storm of the Century” and “Back-to-Back Nor’easters.” The so-called “Storm of the Century” in March 1993 brought rain, high winds to Southeast Virginia and blizzard conditions in western parts of the Commonwealth. In January and February 1998, “Back-to-Back Nor’easters” pounded the Tidewater area, and tides reached 7 feet above MLLW at Norfolk during the second storm (Watson 2002).

Table 3-15 shows storm surge frequencies at Norfolk.

| Table 3-15: Storm Surge Frequency | | | | |
|-----------------------------------|-------------------------|-------------------|--------------------|-------------------|
| Frequency | Return Interval (years) | COE [1997] (feet) | VIMS [1978] (feet) | FWS [1991] (feet) |
| 0.2% | 500 | 9.6 | 8.9 | 9.8 |
| 1% | 100 | 8.2 | 7.5 | 8.5 |
| 2% | 50 | 7.5 | 6.9 | 7.8 |
| 10% | 10 | 6.0 | 4.9 | 6.4 |

Boat Wake

As a boat passes over the water’s surface, part of the energy generated by its propulsion is taken up by the water in the form of surface waves. While the effect of boat wake on shoreline erosion has been little studied, one study (Zabawa and Ostrom 1980) found that wind waves ranked behind storm effects; and in all cases (five sites), boat wakes contributed less energy for erosion than wind waves. Several factors, however, are known to increase the potential for wake related erosion.

The distance at which boats approach the shore is an important factor in evaluating erosion due to boat wakes. For instance, if boats pass too close to the shore, wake energy does not dissipate before reaching the beach. Boat speed and the depth of the water also affect boat wake energy. In small creeks, the largest wakes can be expected from boats

traveling slightly faster than 6 knots at a water depth of about 6 feet (about 8 knots at a water depth of 12 feet). These large wakes produce more energy, thereby increasing the potential for erosion along the shore. However, greatest potential for boating to increase erosion rates above natural levels can be expected when high frequencies of boat passes occur within a few hundred feet of the shore (Zabawa and Ostrom 1980).

Powhatan Creek and Back River are relatively narrow, averaging 100 feet and 200 feet wide, respectively. The shorelines here are therefore fetch-limited (they are not wide enough for winds to play a major part in wave action and erosion), but tidal currents and boat wakes can exacerbate shoreline erosion (Hardaway et al. 1999).

Water Quality

The Virginia Department of Conservation and Recreation classified the Lower James as a Category I Watershed, meaning that it does not meet, or faces imminent threat of not meeting, clean water goals (VDCR 1998). The James River watershed is stressed by a combination of pollutants, including nutrients, toxics, bacteria, and sediments. The James receives the highest combined point and nonpoint nutrient inputs of any of the major Virginia Chesapeake Bay tributaries. About 53% of the controllable nitrogen and 58% of the phosphorus entering the river originate from point sources. Overflows of combined sewers and chemical pollution also pose serious problems, especially during periods of heavy rainfall. Landings of freshwater spawners, such as shad and striped bass, and commercial harvests of market oysters have significantly declined within the area. More than 53,000 acres of once-productive shellfish beds are now closed.

More than 2 million people, nearly one-third of Virginia’s population, live in the James watershed and use its waters. According to the Virginia State Water Control Board (SWCB), there are now 21 significant municipal dischargers and 28 major

industrial dischargers on the river. Most of this extensive urban development and industrial activity is concentrated at or below the fall line in Richmond, Petersburg, Hopewell, and Hampton Roads.

The Virginia Department of Environmental Quality issued the *Virginia Water Quality Assessment 305 (b) Report* in August 2000. In the report, several contaminants were noted in the Lower James. PCBs and chlordane were detected above the human health risk calculated by the Environmental Protection Agency (EPA). Kepone contamination in the Lower James is being monitored. The Lower James is also classified as a 303 (d) water body, based on the requirements of section 303 (d) of the Clean Water Act. Water bodies qualify for this “impaired waters list” when they are too polluted or otherwise degraded to support their designated and existing uses.

The Center for Watershed Protection CWP conducted an assessment of the watershed of Powhatan Creek and presented its findings in the *Baseline Watershed Assessment for Powhatan Creek Final Report* (2001). Ten subwatersheds, the mainstem of Powhatan Creek, and the tidal portion of Powhatan Creek, in which the Jamestown Project site is located, were assessed for hydrologic, geomorphic, biological, and water quality impacts.

The areas were then classified as sensitive, impacted, or nonsupporting, which are defined as follows. Sensitive streams typically have a watershed impervious cover of 0% to 10%, are high quality, and are typified by stable channels, excellent habitat structure, good to excellent water quality, and diverse communities of fish and aquatic insects. Sensitive streams do not experience frequent flooding due to the low impervious cover. Impacted streams typically have a watershed impervious cover ranging from 11 to 25% and show clear signs of degradation due to watershed urbanization. Greater storm flows alter stream geometry, erosion is evident, stream banks are unstable, and physical habitat in the stream

declines noticeably. Stream water quality is in the fair/good category. Nonsupporting streams are ones in which impervious cover exceeds 25%. At this point, the stream channel becomes highly unstable, water quality is rated fair to poor, and contact recreation, such as swimming, is no longer possible because of high bacterial levels. The biological quality of nonsupporting streams is generally considered poor, and dominated by pollution-tolerant insects and fish.

According to the CWP, six subwatersheds of Powhatan Creek were classified as sensitive, and four were classified as impacted as of 2000. The impervious cover within the watershed rose from 3% in 1970 to 9.8% in 2000. Based on the current zoning, the impervious cover is expected to climb to as much as 15.5% in the next two decades. When the amount of impervious cover exceeds 10%, stream and wetland quality begin to decline. Powhatan Creek is very close to crossing this threshold.

Headwater streams that feed into the mainstem of Powhatan Creek show the greatest degradation, with accelerated channel erosion reported in the upper tributaries, which creates sediment deposition within the floodplain and wetlands. Powhatan Creek can have high levels of bacteria during wet weather, which has caused localized closures of shellfish beds in the tidal creek.

The tidal segment of Powhatan Creek, to which the Jamestown Project site belongs, was classified as sensitive and has the potential to be classified as impacted in the near future. Approximately 13% of the area consists of impervious cover, and heavy stormwater pollutant loads from upstream are likely to increase fecal coliform problems. The area is currently listed as a 303 (d) water body, as defined by section 303 (d) of the Clean Water Act.

Water quality in Powhatan Creek is most influenced by nonpoint source pollution from residential areas within the watershed. Powhatan Creek is part of the larger James River Watershed

and water chemistry within the lower portion of Powhatan Creek may be tidally influenced by the James. The majority of the water quality monitoring has been conducted in the tidal portion of Powhatan Creek in association with the James River monitoring. Very few sampling points are present in the headwaters of Powhatan Creek. The Friends of Powhatan Creek, College of William and Mary, VDEQ, Virginia Department of Game and Inland Fisheries (VDGIF), and Virginia Department of Conservation and Recreation (VDCR) have conducted water quality sampling on Powhatan Creek.

Analytical results of nutrient levels – namely ammonia, nitrate and nitrite, TKN (total Kjeldahl nitrogen), total nitrogen, and total phosphorus – indicate that nutrient levels in Powhatan Creek are below the established thresholds. None of the nitrate levels recorded by VDEQ exceeded 2.0 milligrams per liter (mg/L). VDCR has established a threshold of 2.0 mg/L for total nitrate to indicate poor or severe water quality, and the EPA has established a level of 10 mg/L for drinking water. Total nitrogen during average baseflows in Powhatan Creek ranges from 0.55 to 1.25 mg/L. This reflects a developing watershed. Ammonia levels appear high when compared to those of undeveloped watersheds, but are below EPA's surface water standard of 2.0 mg/L. However, ammonia concentrations of 0.1 mg/L can adversely affect fish. Although there is no national criterion for phosphorus concentrations, EPA recommends that in-stream conditions should not exceed 0.1 mg/L, and VDCR qualifies waters with concentrations exceeding 0.2 mg/L as poor or severe. Phosphorus levels in Powhatan Creek are close to 0.1 mg/L, according to VDEQ data.

The Department of Environmental Quality also collected readings for copper, zinc, and lead at three locations in Powhatan Creek. Values for lead and zinc are well below the average national stormwater concentrations (68 and 162 micrograms per liter [µg/L], respectively) (Smullen and Cave 1998). Copper levels from 1992-98 in both the tidal

(20 µg/L) and nontidal (30 µg/L) stations are over the national stormwater average of 13 µg/L.

Total suspended solids (TSS) were monitored by VDEQ and concentrations in Powhatan Creek (26.6 mg/L) were approximately 50% lower than the levels in the James River. TSS levels in Powhatan Creek may be adversely affected by tidal influences from the James.

Fecal coliform levels in Powhatan Creek exceed the federal standards. The VDEQ listed a portion of tidal Powhatan Creek as "impaired" for shellfish harvesting. Sources of fecal coliform include wildlife, pets, farm animals, leaking sanitation lines, failing septic tanks, and marinas.

Overall, the Powhatan Creek water quality is relatively healthy. High concentrations of fecal coliform and copper, and the continued development within the watershed, are major concerns for the present and future water quality of Powhatan Creek.

3.3.2.6 Floodplains and Flood Zones

Executive Order 11988, "Floodplain Management," provides for the protection of floodplain values, while *NPS 93-4: Floodplain Management Guideline*, provides the NPS with requirements for implementing the executive order. Floodplains are fluvial lands adjacent to freshwater streams and rivers that receive floodwaters once the water has overtopped the bank of the main channel. This is typically the result of a higher than normal influx of upstream water supplies (water moving from higher elevations to lower elevations). Floodplains are important resources in the storage and filtering of these floodwaters. Without proper mitigation, construction within a floodplain can result in direct long-term impacts including a decrease in flood storage volumes, the restriction of natural flow patterns, and the exacerbation of catastrophic flooding in downstream areas.

A flood zone is an area subject to the risk of flooding by any natural means, either by water cresting the banks of channels (fluvial floodplain) or by tidal storm surges. Tidal storm surges occur when water is pushed up by high winds from a low elevation to a higher elevation because of coastal storms and hurricanes.

The James River, at the location of Jamestown Island, more closely resembles a bay and estuary system than a true floodplain because the river maintains an average water elevation near sea level. For this reason, the river can be viewed as having an infinite flood storage capacity. It can safely be assumed, therefore, that the Jamestown Island area is not at risk of flooding as a result of water cresting the banks of the James River due to upstream influxes. Additionally, the downstream limit of the Powhatan Creek floodplain that is subject to flooding from upstream water sources occurs approximately 3 miles upstream from Jamestown Island (FEMA 1991).

On the other hand, flooding as a result of a tidal storm surge is a likely scenario. For example, the most severe flood on record occurred in 1933 as a result of an unnamed hurricane when the tidal surge reached an elevation of 8 feet in the Hampton Roads area (FEMA 1991). Areas having a high risk of flooding from tidal storm surges have been identified by the Federal Emergency Management Agency (FEMA) based on a particular elevation. FEMA has determined the 100-year and 500-year flood zone elevations for the Jamestown Island area to be 8.5 and 9.8 feet, respectively. Approximately 1,611 acres (87%) of the project area are at or below 8.5 feet, implying that these areas have the probability of flooding as a result of a storm surge 1 out of every 100 years. Additionally, 63 acres (3%) at or below elevation 9.8 feet (but above 8.5 feet) are identified as being within the 500-year flood zone (moderate risk), meaning the probability of flooding is at least once in 500 years. At Neck of Land, approximately 61 acres are located above the 500-year flood zone (Figure 3-13).

Several structures are present within the 1,611 acres of the project area that are below the 100-year flood zone elevation of 8.5 feet. These include the Glasshouse, the Jamestown Rediscovery™ Center (Yeardley House) with storage sheds, the Dale House, the existing Visitor Center, and parking areas. The top of the seawall along the James River shoreline of the Townsite has an approximate elevation of 7.4 feet.

The Glasshouse is an open-air structure built at ground level that is used as an interpretive center for guests to observe glassblowing and the making of glasswares. The floor elevation appears to approximate ± 5.5 feet, which is 3 feet lower than the 100-year flood elevation and 4.3 feet lower than the 500-year flood elevation.

The Jamestown Rediscovery™ Center, located in the Townsite, is used as the APVA collections center. This structure was constructed at a site having a ground elevation of 6.5 to 7.3 feet. The floor elevation, however, was measured to be above the 500-year flood zone elevation of 9.8 feet by approximately 0.35 feet (10.15 feet).

The Dale House is located at the Townsite just landward of the sea wall to the James River shoreline. This structure was built on land that has an elevation of approximately 5.1 to 6.6 feet. The eastern side of the house maintains a door entrance at the ground level of ± 6.6 feet, which is also the internal floor elevation. The floor of this structure, therefore, is 1.9 feet below the 100-year flood zone elevation.

The Visitor Center is a multilevel structure that was built on sloping land and straddles the 8.5-foot contour elevation. The lower level of the building is currently being used as the collections and storage facility for all Jamestown artifacts and as office space for the curator. The northernmost side of the structure leading into the storage area was built below grade, and has a back door entrance and floor elevation of 3.9 feet. The land surrounding this

entrance (parking area) rises to elevation 5.5 to 6.4, then the elevation drops again toward the edge of Pitch and Tar Swamp. This configuration causes considerable problems due to rainwater flowing toward the building, into the northern entrance, and pooling within the artifact storage area and offices. NPS staff has had to use sand bags during heavy rain events to protect the first floor from unintended stormwater. The southernmost portion of the building is on land approximately 15 feet in elevation, and is above the 500-year flood zone elevation.

The Colonial Parkway within the project area is entirely above the 500-year flood zone elevation with the exception of a portion of the parking area on the Island. One small section of the Parkway just north of the Sandy Bay bridge has an elevation of 8.8, which is 1 foot lower than the 500-year flood zone elevation of 9.8 feet.

3.3.2.7 Wetlands and Deepwater Habitats

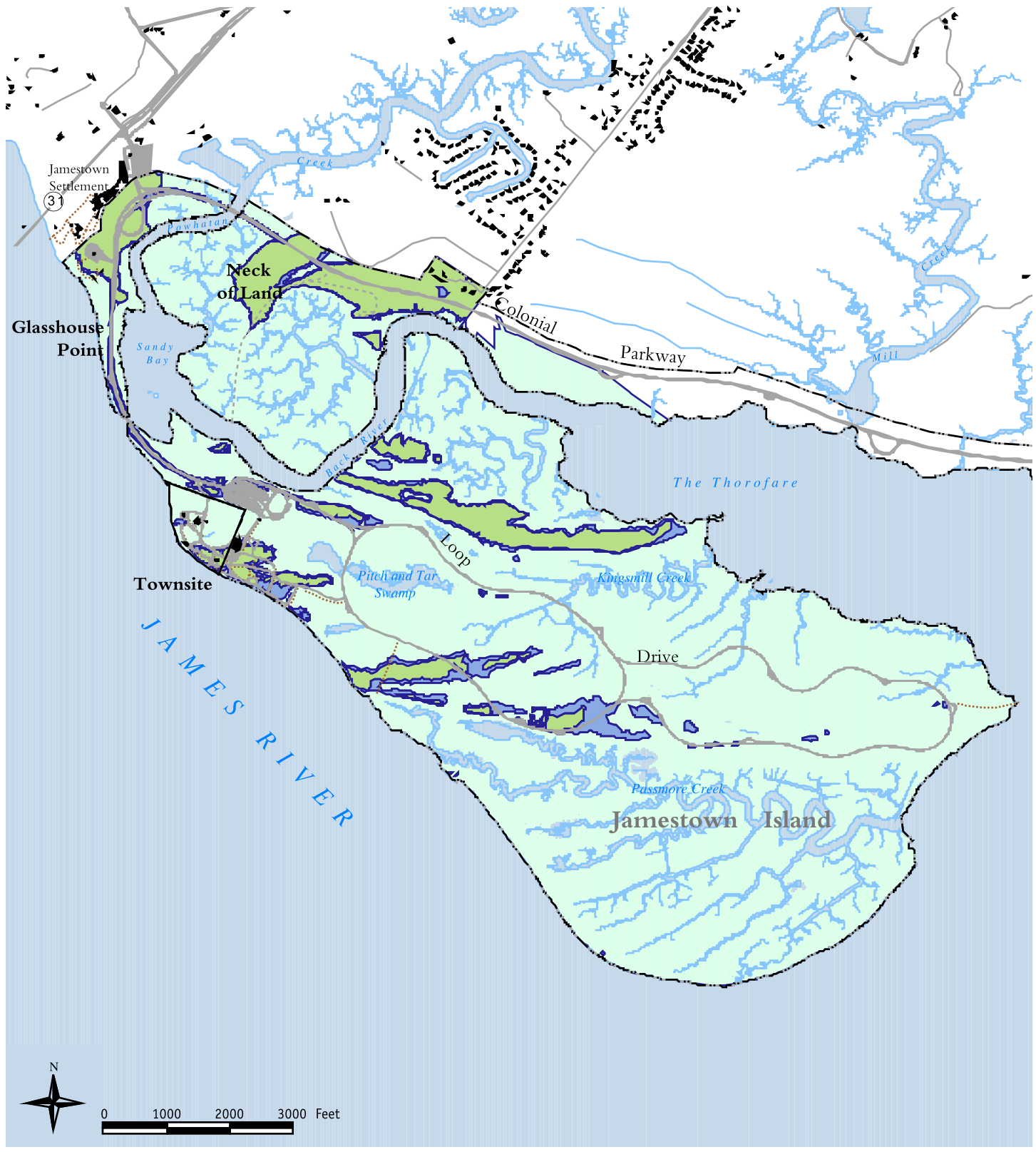
The Environmental Protection Agency and the United States Army Corps of Engineers define wetlands as “areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soils conditions” (COE/DOA 1987). Determination of a jurisdictional wetland requires the presence of three parameters: hydric soil, a dominance of hydrophytic vegetation, and wetland hydrology. This determination is tied to Section 404 of the Clean Water Act, which provides for the protection of water quality of “waters of the United States,” including wetlands, and instructs the COE to issue permits for activities that result in the discharge of dredged or fill material into these areas.

On the other hand, the United States Fish and Wildlife Service (FWS) defines wetlands as “...lands transitional between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is covered by shallow water. For purposes of this classification, wetlands

must have one or more of the following three attributes: (1) at least periodically, the land supports predominantly hydrophytes; (2) the substrate is predominantly undrained hydric soil; and (3) the substrate is nonsoil and is saturated with water or covered by shallow water at some time during the growing season of each year” (Cowardin et al. 1979). This determination is more comprehensive than the COE’s, recognizing that physical or chemical conditions such as wave action, currents, or high salinity may prevent development of hydric soils or hydrophytic vegetation in some wetland types. Therefore, some unvegetated and/or nonhydric soil sites, such as mudflats or high-energy shorelines, may not exhibit all three attributes but are still classified as wetlands.

To comply with Executive Order 11990, “Protection of Wetlands,” the NPS issued *Director’s Order 77-1: Wetland Protection*. This order directs the National Park Service to use the FWS determination as the standard for defining, classifying, and inventorying wetlands and when NPS actions have the potential to adversely impact wetlands. The National Park Service must also comply with Section 404 of the Clean Water Act when those actions involve placing dredged or fill material in wetlands or other “waters of the United States.”

Based on NPS requirements, wetland scientists initiated the identification of wetlands within the study area using the park’s wetlands GIS database, the *National Wetlands Inventory* (NWI), local soil survey, and aerial photographs. This information was verified with field efforts to confirm the presence and type of wetlands. Additionally, wetlands within the immediate vicinity of the Townsite, Neck of Land, Glasshouse Point, and NPS Maintenance Facility were field-delineated and mapped using surveyors’ flagging tape and global positioning system (GPS) equipment (Figure 3-14).

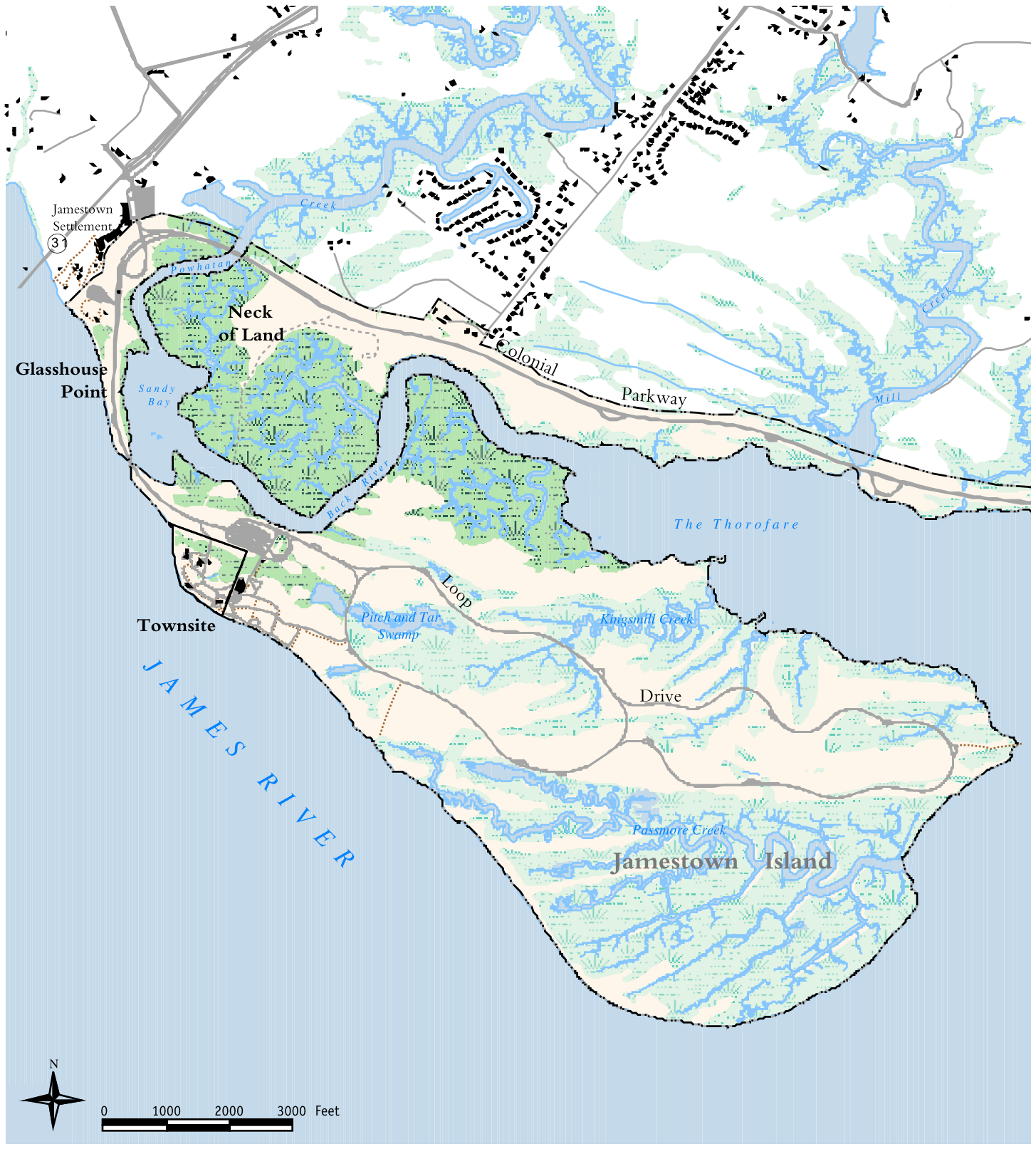


Legend

- 100-Year (Below 8.5 ft contour)
- 500-Year (8.5-ft to 9.8 ft contour)
- Above the 500-Year Flood Zone (Above 9.8-ft contour)

Figure 3-13: 100- and 500-Year Flood Zones

Source: Data from 1-foot contours, ASC and VHB
Vertical datum - National Geodetic Survey Mean Sea Level



Legend





-  Wetlands - Delineated (Per NPS Requirements)
-  Wetlands - Other
-  Colonial National Historical Park
-  Association for the Preservation of Virginia Antiquities

Figure 3-14: Wetlands

Source: Delineated - VHB, 2001 and Environmental Concern Inc., 2000;
Other - National Wetlands Inventory

Field data listing dominant vegetation, hydrology, and soil profiles were taken within the wetland areas in response to delineation requirements by the Army Corps of Engineers (COE/DOA 1987). A cursory inspection of the remaining property, to include most of the Island east of the Townsite, was performed using the NWI information, aerials, and available base mapping. Spot checks were performed, and wetland boundaries were estimated based on aerial photo interpretation. Acreages of mapped wetlands were determined using a planimeter.

The Jamestown study area was found to comprise a total of approximately 1,055 acres of estuarine tidal deepwater habitats and wetlands, nontidal wetlands, and palustrine open-water habitats. Open waters associated with the main channels of Powhatan Creek, Sandy Bay, Back River, The Thorofare, and James River were not included in the acreage figures.

The tidal wetlands surrounding Jamestown Island and Neck of Land lie very close to the upper range of the estuarine environment and the lower range of the freshwater environment. Cowardin et al. (1979) distinguish the boundary between estuarine and palustrine (freshwater) systems to be the point where salinity reaches 0.5 parts per thousand (ppt) during low flow periods. The U.S. Fish and Wildlife Service's *National Wetlands Inventory* identifies the wetlands surrounding the island as palustrine. However, the agency performed a fisheries and water quality study in 1991 in the vicinity of Jamestown Island (Swihart et al. 1991). This report indicates that salinity levels for the main rivers and marsh creeks were 0.0 ppt during the spring of that year, and salinity levels rose to between 4 to 8 ppt during the month of October (period of low flow). Assuming the data represents a normal year, the designation of the area's tidally influenced marshes and adjacent wetland forests may more appropriately be called estuarine. All other wetlands are classified as palustrine.

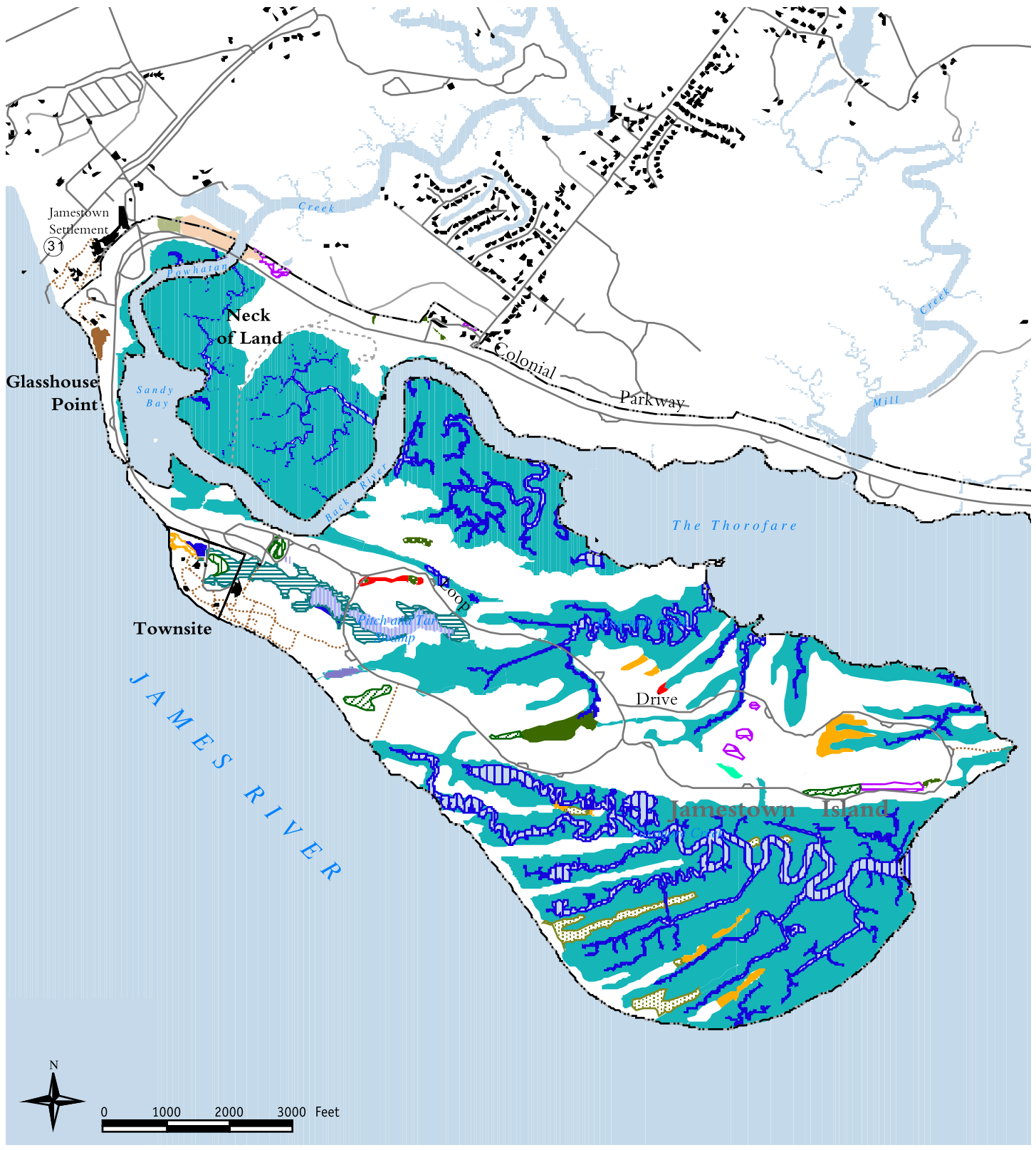
Table 3-16 itemizes the wetland and deepwater habitat types using the Cowardin et al. (1979) classification system, and Figure 3-15 depicts their locations. Most of the wetlands are tidal marshes affiliated with Powhatan Creek, Sandy Bay, Back River, Kingsmill Creek, and Passmore Creek. Pitch and Tar Swamp is a large system composed of forested areas, scrub-shrub wetlands, marsh, and open water. A large beaver dam that crosses the entire marsh influences wetland hydrology of the Pitch and Tar Swamp. It is believed that tidal waters are able to overtop the dam and enter Pitch and Tar Swamp during seasonally high tides. Other wetlands include two small areas delineated adjacent to the NPS Maintenance Facility next to the Colonial Parkway, and a large, isolated wetland on Glasshouse Point.

As noted above, tidally influenced marshes dominate the Jamestown Project site. The oligohaline marshes (E2EM1R) of Passmore Creek and Back River consist primarily of rice cut grass (*Leersia oryzoides*), giant bulrush (*Scirpus validus*), and big cordgrass (*Spartina cynosuroides*). The boundary between the freshwater and oligohaline marsh is not distinct, although plants such as arrow arum (*Peltandra virginica*), duck potato (*Sagittaria latifolia*), and cattails (*Typha latifolia*) indicate the change in salinity to a freshwater system (PEM2R). These species dominate at upstream locations along Powhatan Creek, north of the Colonial Parkway. For this reason, the Parkway was conveniently used as the boundary between the oligohaline and freshwater environments.

Estuarine deepwater habitats occur in the study area in the form of tidal creeks (E1UB3R) and shallow-water ponds (E1UB3V, E1UB3Vb). Numerous tidal creeks (120.6 acres) can be found within the marshes of Neck of Land, Kingsmill Creek, The Thorofare, and Passmore Creek. These channels function as flow ways important to the distribution of tidal waters throughout the large marsh systems. They also serve as habitat to the area fisheries for spawning, cover for fingerlings, and foraging for adults. In addition, waterfowl and wading birds seek these narrow creeks for protection from harsh weather and foraging.

Table 3-16: Wetland and Deepwater Habitat Types and Estimated Acreages

| Wetland Habitat Types | Size (acres) |
|--|---------------------|
| Estuarine, intertidal, emergent, persistent, seasonal tidal (E2EM1R) – Marshes of Passmore Creek, Kingsmill Creek, Back River, and Neck of Land. | 833.2 |
| Estuarine, intertidal, forested, needle-leaved evergreen, seasonal tidal (E2FO4R) – Pine wetlands at Passmore Creek. | 14.0 |
| Estuarine, intertidal, forested, needle-leaved evergreen, seasonal tidal, beavers (E2FO4Rb) – Pine wetland within Pitch and Tar Swamp. | 2.2 |
| Estuarine, intertidal, forested, broad-leaved deciduous, temporary tidal (E2FO1S) – Hardwood slough at upper end of Kingsmill Creek. | 7.3 |
| Estuarine, intertidal, emergent, persistent, seasonal tidal, beavers (E2EM1Rb) – Marsh in Pitch and Tar Swamp. | 21.4 |
| Estuarine, intertidal, scrub/shrub, broad-leaved evergreen, seasonal tidal (E2SS3R) – Wax myrtle wetlands along edges of tidal marsh. | 13.1 |
| Estuarine, intertidal, scrub/shrub, broad-leaved evergreen, seasonal tidal, beavers (E2SS3Rb) – Wax myrtle areas within Pitch and Tar Swamp. | 1.3 |
| Estuarine, intertidal, forested, needle-leaved deciduous, seasonal tidal, beavers (E2FO2Rb) – Cypress wetland at far western end of Pitch and Tar Swamp. | 1.2 |
| Palustrine, emergent, persistent, nontidal, seasonal flooded (PEM1C) – Isolated depression between Townsite and Passmore Creek marsh and marsh finger beside long Loop Drive. | 5.5 |
| Palustrine, forested, broad-leaved deciduous, nontidal, temporary saturated (PFO1A) – Small areas along Loop Drive. | 2.1 |
| Palustrine, forested, broad-leaved deciduous, nontidal, seasonal flooded (PFO1C) – Small areas around Loop Drive. | 2.5 |
| Palustrine, forested, needle-leaved deciduous, nontidal, seasonal saturated (PFO2E) – Cypress depression at Glasshouse Point. | 1.9 |
| Palustrine, forested, broad-leaved deciduous, nontidal, seasonal saturated (PFO1E) – Isolated depressions on east end of Island, finger beside long Loop Drive, and area north of Colonial Parkway at Powhatan Creek bridge. | 5.6 |
| Palustrine, forested, deciduous, seasonal tidal (PFO6R) – Cypress and hardwood area north of Colonial Parkway near Powhatan Creek bridge. | 1.8 |
| Palustrine, unconsolidated bottom, semipermanent flooded (PUBF) – Open-water pond on east end of Island. | 0.9 |
| Palustrine, emergent, nonpersistent, seasonal tidal (PEM2R) – Freshwater marsh just north of Colonial Parkway near Powhatan Creek bridge. | 7.3 |
| Deepwater Habitat Types | |
| Estuarine, subtidal, unconsolidated bottom, mud, seasonal tidal (E1UB3R) – Deepwater tidal creeks. | 120.6 |
| Estuarine, subtidal, unconsolidated bottom, mud, permanent tidal, beavers (E1UB3Vb) – Deepwater habitat associated with Pitch and Tar Swamp. | 12.0 |
| Estuarine, subtidal, unconsolidated bottom, mud, permanent tidal (E1UB3V) – Deepwater habitat (pond) just east of Townsite, connected to James River by tidal ditch. | 1.3 |
| Total Estimated Acreage | 1,055.2 |



Legend

| | | | | | | | |
|--|---------|--|---------|--|---------|--|-------|
| | E2EM1R | | E2F01S | | E2SS3Rb | | PF06R |
| | E2EM1Rb | | E2F02Rb | | PEM1C | | PF01A |
| | E1UB3R | | E2F04R | | PEM2E | | PF01C |
| | E1UB3V | | E2F04Rb | | PEM2R | | PF01E |
| | E1UB3Vb | | E2SS3R | | PF02E | | PUBF |

Figure 3-15: Cowardin Wetland and Deep Water Habitat Classification

Note: See Table 3-16 for abbreviation definitions.

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Four ponds also add to the deepwater habitats on the project site comprising approximately 14.2 acres. A 0.3-acre pond (E1UB3Vb) is located adjacent to the bus parking facility on the Island, which is hydrologically connected to a beaver pond within Pitch and Tar Swamp via an upland cut ditch. A second pond (E1UB3V) is located south of Pitch and Tar Swamp next to an old pecan orchard. This 1.3-acre water body is tidally influenced due to an upland cut ditch and outfall pipe connected to the James River shoreline. While water normally flows out of the pond into the James River, it appears that during extreme high tides, water will reverse flow and tidal water will enter the pond.

A third pond (PUBF), of approximately 0.9-acre in size, is located toward the southeastern end of the Island adjacent to an interpretive station along the Loop Drive. It appears this pond is isolated. The fourth pond comprises an 11.8-acre beaver impoundment (E1UB3Vb) within the interior of Pitch and Tar Swamp. This system occasionally receives tidal water from Kingsmill Creek and is a rich habitat for aquatic and wetland-dependent wildlife, as numerous wading birds, waterfowl, turtles, and ospreys have been observed using the area.

Small, forested wetland systems are also scattered across the study area. A small isolated depression of deciduous hardwoods (PFO1E) is located behind the NPS Maintenance Facility; another just south of the Glasshouse containing bald cypress (*Taxodium distichum*), loblolly pine (*Pinus taeda*), and red maple (*Acer rubrum*) (PFO2E); and several others on the eastern end of the Island (PFO1A, PFO1C, and PFO1E). Dominant species in these areas consist of black gum (*Nyssa sylvatica*), green ash (*Fraxinus pennsylvanica*), willow oak (*Quercus phellos*), and cherrybark oak (*Q. falcata* var. *pagodaefolia*). Most of these systems function as a result of a high water table, although some of the pine wetlands (E2FO4R) adjacent to Passmore Creek are influenced by seasonally high tides. Dominant species within the pine wetlands include loblolly pine, sweetgum

(*Liquidambar styraciflua*), red maple, wax myrtle (*Myrica cerifera*), and greenbriar (*Smilax rotundifolia*).

Wetland Functional Values Assessment

During an earlier phase of the study in 2000, Environmental Concern, Inc. performed a functional values assessment for the Neck of Land wetlands using a methodology they had developed. The methodology, *Evaluation for Planned Wetlands Functional Capacity Index* (EPW) (Bartoldus et al. 1994), was developed to compare six functions and values of proposed impacted wetlands to those wetlands created for mitigation using a scoring system between 0 and 1.0. A higher score implies a higher functional capacity. Because the study area has since expanded to include Glasshouse Point and the Townsite, scientists were directed to use this same methodology to avoid the introduction of complications with two different data sets. For this reason, the use of the EPW methodology was continued.

The EPW methodology analyzes six functions:

- Shoreline Bank Erosion Control – the capacity to provide erosion control and to dissipate erosive forces at the shoreline bank. Vegetated shorelines have been demonstrated to reduce wave energies to minimize erosional processes, especially in tidal environments.
- Sediment Stabilization – the capacity to stabilize and retain previously deposited sediments.
- Water Quality – the capacity to retain/process dissolved and/or particulate material to benefit downstream surface water quality. Through chemical transformation processes and/or through settling processes of accretion, nutrients and other pollutants are reduced by wetland systems.

- **Wildlife** – the degree to which a wetland functions as a habitat for wildlife, termed the habitat complexity of the wetland. Horizontal and vertical vegetation stratifications have been demonstrated to provide for wildlife richness and diversity as layering and more complex cover type interspersions increase.
- **Fish**
 - **Tidal** – the degree to which a wetland habitat meets the food/cover, reproductive, and water quality requirements of fish in a tidal system.
 - **Nontidal** – the degree to which a wetland habitat meets the food/cover, reproductive, and water quality requirements of fish in nontidal stream/river systems, ponds, and lakes.
- **Uniqueness/Heritage** – the presence of characteristics that distinguish a wetland as unique and/or valuable from a human perspective. Examples include rare and endangered species habitat, educational purposes, and/or wetlands known to be of special concern by the regulatory authorities.

Another important wetland value not included in this methodology, however, is floral diversity, which was added to the study. To determine floral diversity, wetland scientists visited wetlands in the study area to document the common species of plants occupying each wetland. The total number of species within each wetland type was used as a floral diversity relative index. This will be the only score in the assessment higher than 1.0.

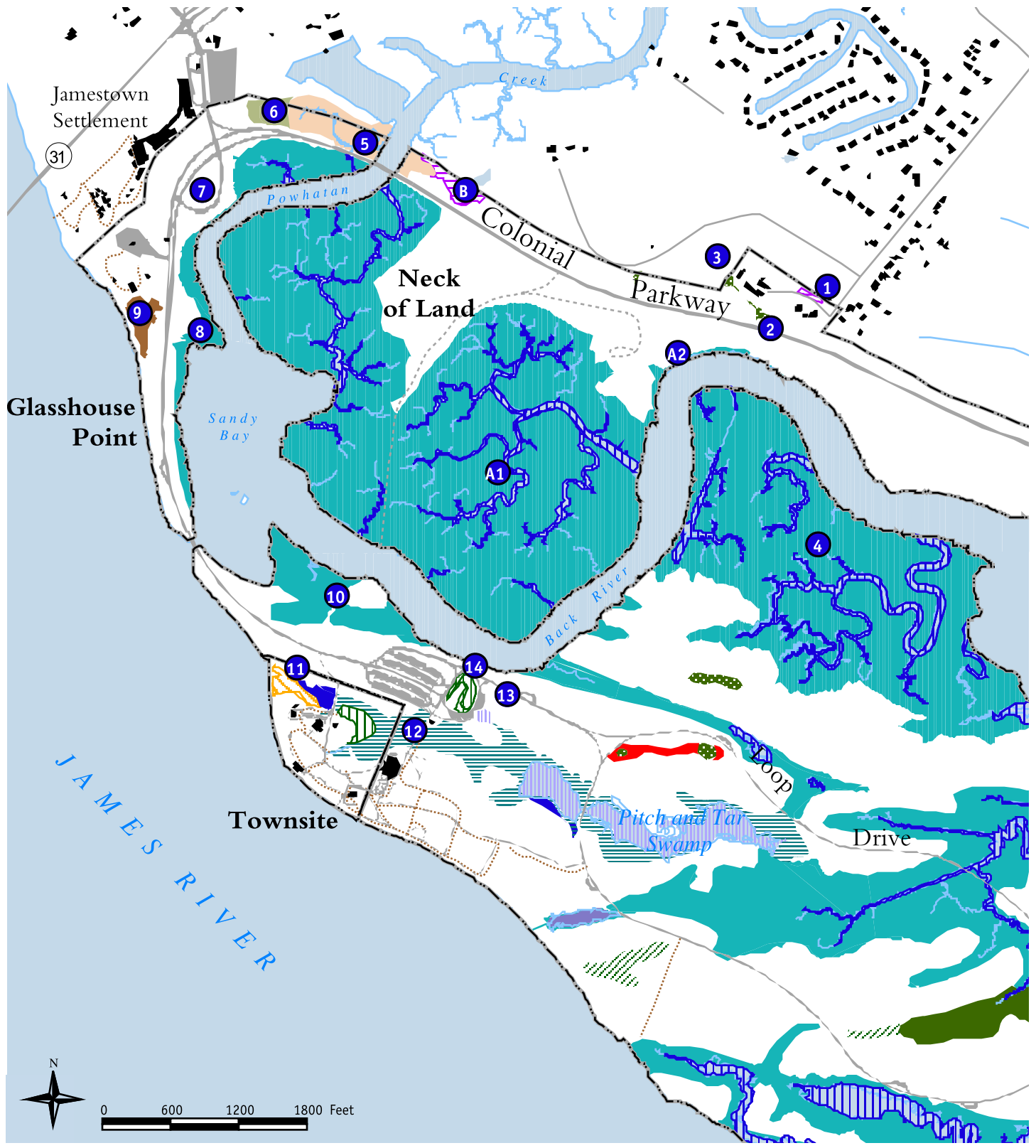
Before the functional value study was performed, knowledge about the wetland types was gained based on a cursory inspection of the wetlands in addition to the delineation work. Wetland scientists itemized the wetlands by various functional capacities relative to their location, landscape

position, vegetative cover, and/or hydrology. The boundary of each wetland was mapped, and the EPW methodology was applied to each mapped wetland (Figure 3-16).

Table 3-17 lists the resulting scores for each of the wetlands assessed. A score of N/A was given for a wetland that provided no functional value for that category (synonymous with a score of 0.0). Scores (except for the Floral Species Diversity value) for Wetlands A1, A2, and B (Neck of Land area) were determined in the year 2000 by Environmental Concern, Inc., while Vanasse Hangen Brustlin, Inc. (VHB) examined the remaining wetlands in 2001. Appendix G contains the appropriate datasheets for each wetland assessed.

According to methodology criteria, all of the wetlands, except Wetland 3 (which was too small, based on the size requirement), offer some functional value. The analysis has shown that the marshes associated with Powhatan Creek, Sandy Bay, and Back River (Wetlands 4 through 8, 10, and A1) offer the most overall functional values of the wetlands studied. Wetlands A1, 4, and 5 offer the highest level of shoreline bank erosion control, while Wetlands 7 and A2, although adjacent to tidal waters, contained steeply eroded banks, resulting in lower shoreline bank erosion control scores.

Most of the wetlands scored high for sediment stabilization and water quality. Under the normal process for scoring wetlands in this category, isolated wetlands or wetlands with one outlet would have no score (N/A). However, it was the opinion of the wetland scientists that several wetlands, because of their ability to capture surface runoff from neighboring upland areas, did offer water quality functions, and their scores were determined. Systems with large amounts of vegetative cover to filter pollutants scored the highest in this category. Other than those with a N/A score, Wetland 7, with its steep, eroded bank scored the lowest due to its lack of vegetation.



Legend

| | | | | | | | |
|--|---------|--|---------|--|---------|--|-------|
| | E2EM1R | | E2F01S | | E2SS3Rb | | PF06R |
| | E2EM1Rb | | E2F02Rb | | PEM1C | | PF01A |
| | E1UB3R | | E2F04R | | PEM2E | | PF01C |
| | E1UB3V | | E2F04Rb | | PEM2R | | PF01E |
| | E1UB3Vb | | E2SS3R | | PF02E | | PUBF |

Figure 3-16: Wetland Functional Assessment

Notes:
Numbers # correspond to Table 3-17,
Wetland Functional Values Analysis Results

See Table 3-16 for abbreviation definitions.

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Wetlands with multiple vegetative layers, fallen logs, and organic debris tend to provide the highest value for wildlife habitat. These conditions were most exemplified by Wetland 1, an isolated depression behind the NPS Maintenance Facility (score 0.64). Wetland 12, the Pitch and Tar Swamp, had the second-highest score as wildlife habitat (score 0.56), and Wetland 2, a mowed depression in front of the NPS Maintenance Facility, had the lowest score due to its lack of vegetative cover layers.

Those wetlands that contain fisheries habitat were scored as tidally influenced systems. Wetlands A1, 4, 5, and 10 rated the highest due to the vegetative cover for foraging, protection, and potential for spawning habitat. Wetland 7 offers very little vegetation for fingerling protection and adult spawning, although downed trees lying in the channel do provide some cover.

Table 3-17: Wetland Functional Values Analysis Results

| Wetland Assessed | Shoreline Bank Erosion Control | Sediment Stabilization | Water Quality | Wildlife | Tidal Fisheries | Nontidal Fisheries | Uniqueness and Heritage | Floral Species Diversity |
|------------------|--------------------------------|------------------------|---------------|----------|-----------------|--------------------|-------------------------|--------------------------|
| 1 | N/A | 0.875 | N/A | 0.64 | N/A | N/A | 1.00 | 5 |
| 2 | N/A | 0.88 | 0.81 | 0.13 | N/A | N/A | 1.00 | 3 |
| 3 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 4 | 0.86 | 0.90 | 0.90 | 0.45 | 0.72 | N/A | 1.00 | 7 |
| 5 | 0.86 | 0.90 | 0.90 | 0.45 | 0.72 | N/A | 1.00 | 7 |
| 6 | N/A | 0.95 | 0.88 | 0.71 | 0.48 | N/A | 1.00 | 18 |
| 7 | 0.36 | 0.13 | 0.55 | 0.36 | 0.30 | N/A | 1.00 | 7 |
| 8 | 0.75 | 0.73 | 0.86 | 0.33 | 0.58 | N/A | 1.00 | 6 |
| 9 | N/A | 0.88 | N/A | 0.55 | N/A | N/A | 1.00 | 5 |
| 10 | 0.75 | 0.75 | 0.88 | 0.43 | 0.68 | N/A | 1.00 | 16 |
| 11 | N/A | 0.47 | 0.95 | 0.55 | N/A | N/A | 1.00 | 10 |
| 12 | N/A | 0.95 | 0.88 | 0.56 | 0.55 | N/A | 1.00 | 11 |
| 13 | N/A | 0.73 | 0.72 | 0.17 | 0.49 | N/A | 1.00 | 8 |
| 14 | N/A | 0.87 | 0.93 | 0.55 | 0.45 | N/A | 1.00 | 8 |
| A1 | 0.86 | 0.90 | 0.90 | 0.51 | 0.72 | N/A | 1.00 | 7 |
| A2 | 0.28 | 0.31 | 0.41 | 0.21 | 0.40 | N/A | 1.00 | 9 |
| B | N/A | 0.90 | N/A | 0.81 | N/A | N/A | 1.00 | 19 |

Unique wetlands – wetlands occupied by rare, threatened, and endangered species, or wetlands within parks – have been viewed as important to human interests. In taking this into consideration, the EPW methodology views all wetlands within natural parks and conservation areas as unique. Similarly, wetlands occupied by rare, threatened, and endangered species are, by virtue of their importance to the species, given the highest rating for heritage values. Wetlands within the Jamestown Project study area provide both unique and heritage values as part of the NPS and APVA property and as habitat for the bald eagle and sensitive joint-vetch. Therefore, all wetlands were given the score of 1.0, with the exception of Wetland 3. This wetland is a very small, temporarily saturated, isolated depression with virtually no functional importance based on the methodology used to determine functional value.

3.3.2.8 Groundwater

Six confined aquifers, or significant water-bearing geologic layers, and an overlying water table aquifer, characterize the groundwater resources of the York-James Peninsula. They include the Columbia, Yorktown-Eastover, Chickahominy-Piney Point, Aquia, Upper Potomac, Middle Potomac, and Lower Potomac Aquifers. All but the Aquia Aquifer are located at the Jamestown Project site. Confining beds that restrict, but do not prohibit, the vertical flow of water between the layers separate the aquifers in this area. The aquifers consist primarily of sand, or interbedded sand and clay, while the confining layers consist mainly of silt and clay. The main vertical recharge area for the Coastal Plain aquifers extends from eastern Henrico County to Newport News.

According to the United States Geological Survey (USGS) report, *Ground-Water Discharge from the Coastal Plain of Virginia* (Richardson 1994), the Jamestown area is classified as poorly drained lowlands. The groundwater discharge for the gauge station, located in an inland area within the James River Basin, is 9.7 inches per year.

Individual aquifers located at the Jamestown Project site are discussed in detail below, and Table 3-18 summarizes available groundwater quality data as compiled by the USGS (Focazio et al. 1993). The USGS did not provide exact data for the aquifers but instead provided isoconcentration diagrams. The values in Table 3-18 represent estimates based on these diagrams.

Columbia Aquifer. The Columbia Aquifer (also known as the Quaternary Aquifer) is commonly the first aquifer encountered below the land surface in the Coastal Plain. It is a water table aquifer, consisting of sand, silt, and some gravel. With pumping rates of 10 to 50 gallons per minute (gpm), it is usually adequate for domestic use. Groundwater quality is highly variable with iron and hydrogen sulfide often causing a problem. The Columbia Aquifer may be easily polluted because it is shallow.

Yorktown-Eastover Aquifer. The Yorktown-Eastover Aquifer (also known as the Miocene Aquifer) is an important aquifer in the Coastal Plain. It occurs below the water table aquifer and is commonly used for domestic purposes. It typically consists of sand lenses, sand units, and shell beds interbedded with silt and clay. It is unconfined throughout its western extent but is overlain by the Yorktown confining unit in the central and eastern Coastal Plain, where the Jamestown Project site is located. Groundwater quality is generally good in this aquifer except in some areas with high concentrations of iron and hydrogen sulfide. The aquifer may be saline along the ocean or estuary shorelines. The potential for migration of pollutants within the aquifer is moderate. No groundwater quality data was available for this aquifer in the immediate vicinity of Jamestown Island; however, the data presented in Table 3-18 was obtained from a well located southwest of Williamsburg.

Table 3-18: Aquifer Groundwater Quality Data

| Aquifer Name | pH | Dissolved Solids (mg/L) | Hardness (mg/L) | Alkalinity (mg/L) | Sodium (mg/L) | Sulfate (mg/L) | Chloride (mg/L) | Fluoride (mg/L) | Silica (mg/L) |
|------------------------------------|---------|-------------------------|-----------------|-------------------|---------------|----------------|-----------------|-----------------|---------------|
| Yorktown-Eastover | 5.6 | 159 | 114 | 110 | 11.0 | 3.2 | 10.0 | 0.1 | 18 |
| Chickahominy-Piney Point | 6.5 | 300 | <60 | 250 | 100 | 10 | 50 | 1.0 | 35 |
| Upper Potomac | 8.0 | 400 | 10 | 300 | 200 | 10-15 | 30 | >2.0 | 30 |
| Middle Potomac | 7.5-8.0 | 500 | 5 | 300 | 200 | 10 | 50 | 2.0 | 30 |
| Lower Potomac | 7 | 2,500 | 30 | 500 | 1,000 | 100 | 1,000 | <0.5 | <20 |
| Virginia Anti-degradation Standard | 6.5-9.0 | 1,000* | 120* | 30-500 | 100** | 50 | 50 | 1.4 | -- |
| EPA SMCL | 6.5-8.5 | 500 | -- | -- | | 250 | 250 | 4.0 | -- |

Notes: mg/L=milligrams per liter

EPA SMCL = U.S. Environmental Protection Agency Secondary Maximum Contaminant Level

* The American Water Works Association's potable water quality goal is no greater than 200 mg/L for dissolved solids and 80 mg/L for hardness.

** The Commonwealth of Virginia advises people on sodium-restricted diets not to drink water with sodium concentrations greater than 20 mg/L, if the restriction is severe, and 270 mg/L if moderate.

Chickahominy-Piney Point Aquifer. The Chickahominy-Piney Point Aquifer consists of middle to late Eocene sandy deposits (mainly quartz and glauconitic sands) of the Chickahominy and Piney Point formations. The western portion of the Coastal Plain is an important recharge area for this aquifer. Potential movement of pollutants through this aquifer is considered moderate, and the aquifer may be saline near estuaries and the ocean. The estimated values in Table 3-18 include samples from a well north of Jamestown Island.

Upper Potomac Aquifer. The Upper Potomac Aquifer (also known as the Brightseat-Upper Potomac Aquifer) consists of the Potomac Formation and the Brightseat Formation. It contains alternating beds of sand, silt, and clay. The Upper Potomac Aquifer yields the largest supply of water within the York-James Peninsula. The estimated values in Table 3-18 include samples from three wells located near Jamestown Island.

Table 3-19: Summary of EPA STORET Groundwater Data for Wells Located on James River

| | | Screened | | | | | |
|-------------|------------------------|------------------------|---|--------|--|--|------------------------------|
| Well ID | Depth of Well | Interval | Location of Well | | | | |
| COLO_GWGS3 | 159 ft | 61-159 ft | Across Colonial Parkway from Gospel Spreading Farm barn near James River; located in manhole. | | | | |
| COLO_GWGS4 | 370 ft | 90-370 ft | 328 ft east of COLO_GWGS3; located in manhole. | | | | |
| COLO_GWK1 | 248 ft | 100-248 ft | East side of Parkway facing James River; near Kingsmill development. | | | | |
| COLO_GWK2 | 231 ft | 100-231 ft | 52 ft north-northwest of COLO_GWK1; east side of Parkway, near Kingsmill development. | | | | |
| COLO_GWK3 | 360 ft | 75-360 ft | 66 ft northeast of well COLO_GWK1; east side of Parkway, near Kingsmill development. | | | | |
| COLO_GWK4 | 278 ft | 125-278 ft | 197 ft north of well COLO_GWK1; east side of Parkway, near Kingsmill development. | | | | |
| COLO_GWPL1 | 450 ft | 370-450 ft | North side of Parkway near James River; near culvert facing Pages Landing development. | | | | |
| COLO_GWPL2 | 375 ft | 330-375 ft | 98 ft west of COLO_GWPL1 on James River; near culvert facing Pages Landing development. | | | | |
| COLO_SWGS3H | --- | --- | In culvert on the Parkway draining the Gospel Spreading Farm feedlot. | | | | |
| Well ID | Water Temperature (°C) | Conductivity (mmho/cm) | DO (mg/L) | pH | Dissolved NH ³ and NH ⁴ (mg/L) | Dissolved NO ² and NO ³ (mg/L) | Dissolved Phosphorous (mg/L) |
| COLO_GWGS3 | 18.6 | 505.75 | 2.7167 | 6.8125 | 0.85875 | 1.081 | 0.00465 |
| COLO_GWGS4 | 13.425 | 295.25 | 5.1167 | 6.00 | 0.19225 | 0.9395 | 0.0105 |
| COLO_GWK1 | 15.425 | 459.5 | 1.2867 | 6.610 | 0.1605 | 0.03275 | 0.00205 |
| COLO_GWK2 | 15.0 | 700.5 | 0.62667 | 6.890 | 0.3775 | 0.02275 | 0.08125 |
| COLO_GWK3 | 15.0 | 568.25 | 1.7233 | 7.0825 | 0.06875 | 0.1330 | 0.0109 |
| COLO_GWK4 | 14.675 | 606.5 | 3.2833 | 7.1275 | 0.049 | 0.1095 | 0.0049 |
| COLO_GWPL1 | 15.475 | 276.75 | 4.0533 | 6.25 | 0.027 | 0.73475 | 0.007 |
| COLO_GWPL2 | 15.35 | 278.75 | 1.28 | 6.447 | 0.031 | 0.27825 | 0.00375 |
| COLO_SWGS3H | 21.8 | 854.5 | 2.4 | 7.325 | 1.333 | 0.6075 | 0.3835 |

Notes: mmho/cm = micromhos/centimeter
mg/L = milligrams/liter
NH³ = ammonia

NH⁴ = ammonium ion
NO² = nitrite
NO³ = nitrate

Middle Potomac Aquifer. The Middle Potomac Aquifer consists of early Cretaceous deposits of interlensed medium sand, silt, and clay. It yields the second-largest supply of water in the York-James Peninsula. The estimated water quality values in Table 3-18 include samples from three wells located near the Island.

Lower Potomac Aquifer. The lower Potomac aquifer consists of Early Cretaceous deposits of the Potomac Formation. The sediments include interbedded sequences of coarse sand, clayey sand, and clay, and it is the thickest of all the aquifers. The estimated values in Table 3-18 include samples from three wells near Jamestown Island.

The Virginia Institute of Marine Science also compiled and analyzed groundwater quality data from the Jamestown Project site as part of a project titled *Determination Ground Water Quality in Colonial National Historical Park Virginia at Locations Proximal to Urban and Agricultural Land Uses* (MacIntyre 1993). Several monitoring wells are located near Jamestown Island, and Table 3-19 summarizes the water quality data collected at those wells.

3.3.2.9 Vegetation

The following section describes the vegetative communities and exotic invasive species within the Jamestown Project site. Ecologically sensitive areas and state and federally protected species are discussed under the “Rare, Threatened, and Endangered Species” section of this document.

Communities and Species

Jamestown Island offers an excellent assortment of mature, undisturbed habitat types typical of the Virginia Coastal Plain, many of which closely resemble habitats the European settlers probably experienced when they first arrived. These habitat types offer significant diversity and productivity as they relate to hydrology and topography of the landscape. Habitats range from tidal riverine waters,

tidal freshwater marshes, forested swamps, and upland pine/hardwood forests.

Vanasse Hangen Brustlin, Inc. (VHB) performed a vegetative communities inventory of the study. The various vegetative cover types in the project site were classified using the *Natural Communities of Virginia Classification of Ecological Community Types* (Fleming et al. 2001) and cross-referenced to the “formation” level using the *Standardized National Vegetation Classification System* (The Nature Conservancy and Environmental Systems Research Institute 1994). Seven cover types totaling 1,772.1 acres were identified based on orthophotos, 200-foot scale glossy color photographs, National Wetland Inventory maps, and field reconnaissance. Wetland cover types are generalized within this section; however, a more detailed description and classification of wetlands using the Cowardin et al. (1979) classification system is provided in the “Wetlands” section of this document.

The Virginia Department of Conservation and Recreation, Division of Natural Heritage (VDNH) also performed an ecological communities inventory of the Jamestown project area for the NPS (Weber and Coulling 2002). VDNH examined 19 sample plots across the entire project area, 10 of which were in the estuarine tidal marsh, 7 in the upland forest, and 2 in the palustrine wetland forest communities. Data included a listing of the vascular plants within each plot, the slope of the landscape, soil surface substrate, and mineral soil composition in the A-horizon. The results yielded 6 distinct vegetative groups, which were classified to the species alliance level using the *Standardized National Vegetation Classification System*.

Slight differences were observed between the vegetation communities inventory performed by VDNH and VHB. VHB’s work, while focusing much effort on the wetland inventory, resulted in several small forested and scrub-shrub wetland communities undetected by VDNH. These included several isolated depressions and several scrub-shrub wetlands

extending off the tidal marsh located within the interior of the easternmost loop of the Loop Drive. In addition, the VDNH inventory excluded the wetland dominated by loblolly pine and wax myrtle located between the main parking area and the bus parking area, as well as the wetland immediately behind (north of) the Jamestown Rediscovery™ Center. On the other hand, VHB classified the community types to the “formation” level rather than the species alliance level. This resulted in the tidal marsh being classified more generally by VHB compared to VDNH, who subcategorized the tidal marsh more accurately into 6 separate community types based on species dominance.

Approximately 88% of the study area contains vegetated natural communities. (Natural communities may contain some exotic species.)

The remainder consists of developed infrastructure, buildings, mowed yards/fields associated with park operations, and open-water ponds and tidal creeks. Table 3-20 compares the amount of each cover type in the project area. Descriptions and general locations of the natural community cover types are also included below (Figure 3-17).

Mesic Mixed Hardwood Forest

The mesic mixed hardwood forest type described in the *Natural Communities of Virginia* classification system is the community type which most closely resembles the uplands within the Jamestown project area. This type, however, can be separated further into additional community types using the *Standardized National Classification System*. These types are shown in Table 3-20, corresponding to pine, mixed pine/hardwood, and deciduous hardwood forests.

Table 3-20: Vegetative and Non-vegetative Cover Types

| Natural Communities of Virginia | Standardized National Vegetation Classification System | Area (acres) | Percent of study area |
|---------------------------------------|---|--------------|-----------------------|
| Mesic Mixed Hardwood Forest | 1. Needle-leaved Evergreen Forest with Rounded Crowns 2. Lowland and Submontane Broad-leaf Cold Deciduous Forest 3. Mixed Needle-leaved Evergreen – Cold Deciduous forest | 649.6 | 36.6 |
| Nonriverine Swamp Forest | Cold Deciduous Semipermanently Flooded Forest | 1.9 | 0.1 |
| Nonriverine Wet Hardwood Forest | Cold Deciduous Seasonally/Temporarily Flooded Forest | 15.7 | 0.9 |
| Tidal Freshwater Marsh | Freshwater Tidal Regularly Flooded Perennial Forb Vegetation | 7.3 | 0.4 |
| Tidal Oligohaline Marsh | Brackish Tidal Regularly Flooded Tall Grassland Vegetation | 854.7 | 48.2 |
| Tidal Shrub Swamp | Brackish Tidal Regularly Flooded Broad-leaved Evergreen Shrubland | 14.4 | 0.8 |
| Tidal Hardwood Swamp | Cold Deciduous Seasonally/Temporarily Flooded Forest | 10.3 | 0.6 |
| Estuarine Fringe Pine Forest | Needle-leaved Evergreen Seasonally/Temporarily Flooded Forest with Rounded Crowns | 16.2 | 1.0 |
| Tidal Creeks and Ponds | N/A | 133.9 | 7.6 |
| Developed Park and Interpretive Areas | N/A | 40.7 | 2.3 |
| Open Fields | N/A | 27.4 | 1.5 |

Uplands comprise approximately 649.6 acres found on ridges and side slopes adjacent to area marshes and rivers. While the classification of the mesic mixed hardwood forest is generally restricted to a mixture of hardwoods, it is appropriate to include loblolly pine (*Pinus taeda*) as a contributing component to the cover type. Braun (1950) more accurately describes the area as being within the oak/pine region of the Coastal Plain physiographic province. In addition to loblolly pine, common species include oaks (*Quercus falcata* var. *pagodaefolia*, *Q. nigra*, *Q. alba*, *Q. falcata*), sweetgum (*Liquidambar styraciflua*), red maple (*Acer rubrum*), black gum (*Nyssa sylvatica*), American beech (*Fagus grandifolia*), American holly (*Ilex opaca*), persimmon (*Dyospiros virginiana*), flowering dogwood (*Cornus florida*), and yellow poplar (*Liriodendron tulipifera*). Dominant understory species include wax myrtle (*Myrica cerifera*), red bay (*Persea palustris*), grape (*Vitis rotundifolia*), honeysuckle (*Lonicera japonica*), greenbriar (*Smilax rotundifolia*), poison ivy (*Toxicodendron radicans*), and chasmanthium (*Chasmanthium sessiliflorum*).

Nonriverine Swamp Forest

The nonriverine swamp forest community type comprises a single forested depression driven by a high water table. Approximately 1.9 acres make up this type, located just west of the entrance road below the Glasshouse. This site is separated from the James River by a sandy beach, and is characterized by the presence of cypress (*Taxodium distichum*), black gum, red maple, and loblolly pine. Understory species include red bay, chain fern (*Woodwardia* spp.), wax myrtle, sedges (*Carex hyalinolepis*), and soft rush (*Juncus effusus*). A colony of bamboo cane (*Phyllostachys aurea*) is located within this wetland and the adjacent upland area. This type corresponds to the cold deciduous semipermanently flooded forest using the *Standardized National Classification System*.

Nonriverine Wet Hardwood Forest

Several hardwood depressional areas on the Island are classified as nonriverine wet hardwood forest

occupying approximately 15.7 acres. The hardwood forest areas are distinguished from the swamp forest by the degree of inundation and hydroperiod, the swamp forest having longer periods of surface inundation. The hardwood forest areas, on the other hand, are either seasonally saturated or inundated due to a high groundwater table, which usually occurs during the late winter/early spring. Common tree species occupying these depressions include willow oak (*Quercus phellos*), swamp chestnut oak (*Q. michauxii*), red maple, sweetgum, cherrybark oak (*Q. coccinea* var. *pagodaefolia*), elm (*Ulmus rubra*), and loblolly pine. Midstory and understory vegetation include wax myrtle, sedges, soft rush, chain ferns, iris (*Iris* spp.), greenbriar, and poison ivy. The type corresponds to the cold deciduous seasonally/temporarily flooded forest using the *Standardized National Classification System*.

Several small non-tidal, palustrine wetlands dominated by herbaceous plants are scattered across the project site. The *Natural Communities of Virginia Classification of Ecological Community Types* does not recognize separately a non-tidal, freshwater marsh, which is a more fitting description of these areas. As a result, these communities are shown as part of the nonriverine hardwood forest, since they are all relatively small depressions usually surrounded by forested communities.

Tidal Freshwater Marsh

Jamestown Island is situated along the banks of the James River, very near the divide between freshwater and oligohaline environments. Saline concentrations below 0.5 parts per thousand (ppt) have been designated as the breaking point between oligohaline and freshwater systems. The exact boundaries of the freshwater/oligohaline types, however, are poorly defined. However, the tidal freshwater marsh is estimated to comprise approximately 7.3 acres in the vicinity of the Colonial Parkway bridge crossing Powhatan Creek. Typically, these systems are recognized by the presence of broad-leafed, nonpersistent emergent

vegetation such as arrow arum (*Peltandra virginica*), pickerelweed (*Pontederia cordata*), and duck potato (*Sagittaria* spp.). Intermixed with the nonpersistent vegetation are groupings of rice cutgrass (*Leersia oryzoides*) and wild rice (*Zizaniopsis miliacea*). The *Standardized National Classification System* recognizes this as the freshwater tidal regularly flooded perennial forb vegetation community type.

Tidal Oligohaline Marsh

Waters within Back River, The Thorofare, and the James River begin to reach salinity levels exceeding 0.5 ppt. These oligohaline environments influence the vegetative composition of the surrounding marshes such as represented by Neck of Land/Back River marsh, Kingsmill Creek marsh along the northern portion of the Island, and Passmore Creek marsh on the southern end of the Island. The tidal oligohaline marshes in the study area comprise approximately 854.7 acres and are recognized by the presence of persistent herbaceous vegetation such as big cordgrass (*Spartina cynosuroides*), cattails (*Typha* spp.), switchgrass (*Panicum virgatum*), bulrush (*Scirpus americanus*), and rice cutgrass. The *Standardized National Classification System* recognizes this as the brackish tidal regularly flooded tall grassland vegetation community type.

Tidal Shrub Swamp

The tidal shrub swamp community comprises wetland scrub/shrub habitats typically found immediately upstream from the freshwater and oligohaline marshes. The scrub community is found throughout several portions of the Island (totaling 14.4 acres) where seasonally high tides affect the functioning capacity of these systems. The dominant shrub species is almost exclusively wax myrtle, with patches of soft rush, switchgrass, and cattails. Stressed saplings of loblolly pine, red maple, black gum, elm, and cypress were also observed. The *Standardized National Classification System* recognizes this as the brackish tidal regularly flooded broad-leaved evergreen shrubland community type.

Tidal Hardwood Swamp

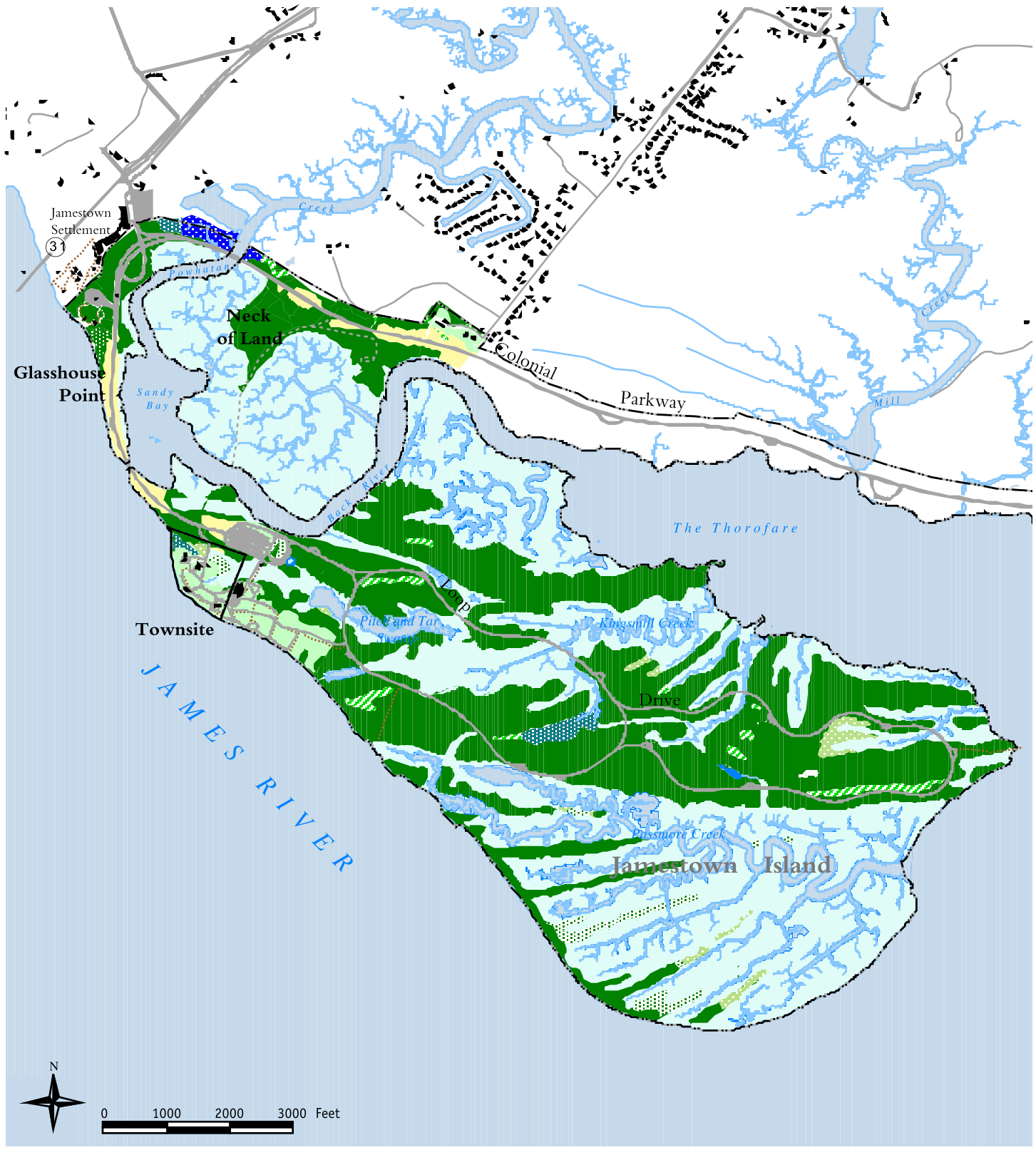
The upper reaches of several seasonally tidal creeks are swamps dominated by hardwood trees. These areas comprise approximately 10.3 acres in the study area and typically have surface water most of the year. The dominant trees include loblolly pine, cypress, black gum, red maple, and sweetgum. Wax myrtle, soft rush, greenbriar, sedges, and chain ferns tend to be the dominant understory plants. This type corresponds to the cold deciduous seasonally/temporarily flooded forest type using the *Standardized National Classification System*.

Estuarine Fringe Pine Forests

This community type occurs along the upper fringes of the tidally influenced marshes and creeks. Loblolly pine is the dominant tree, with wax myrtle and greenbriar as the most common understory species. This community type occurs mostly as fingers surrounded by marsh in the vicinity of Passmore Creek at the western side of Jamestown Island and is an important roosting/nesting location for bald eagles and wading bird rookeries. Estuarine fringe pine forests comprise approximately 16.2 acres of the study area and correspond to the Needle-leaved Evergreen seasonally/temporarily flooded forest with rounded crowns forest type using the *Standardized National Classification System*.

Invasive Exotic Species

Invasive exotic plant species are typically found along roadsides or in areas that have been disturbed in some fashion or another. In some instances, these species have been found to penetrate natural communities because of their rapid growth and maturity, rampant vegetative spread, prolific seed production and dispersal, and aggressive ability to outcompete native species. This is most commonly seen in natural areas adjacent to or fragmented by a disturbed site so the integrity of the native community is threatened.



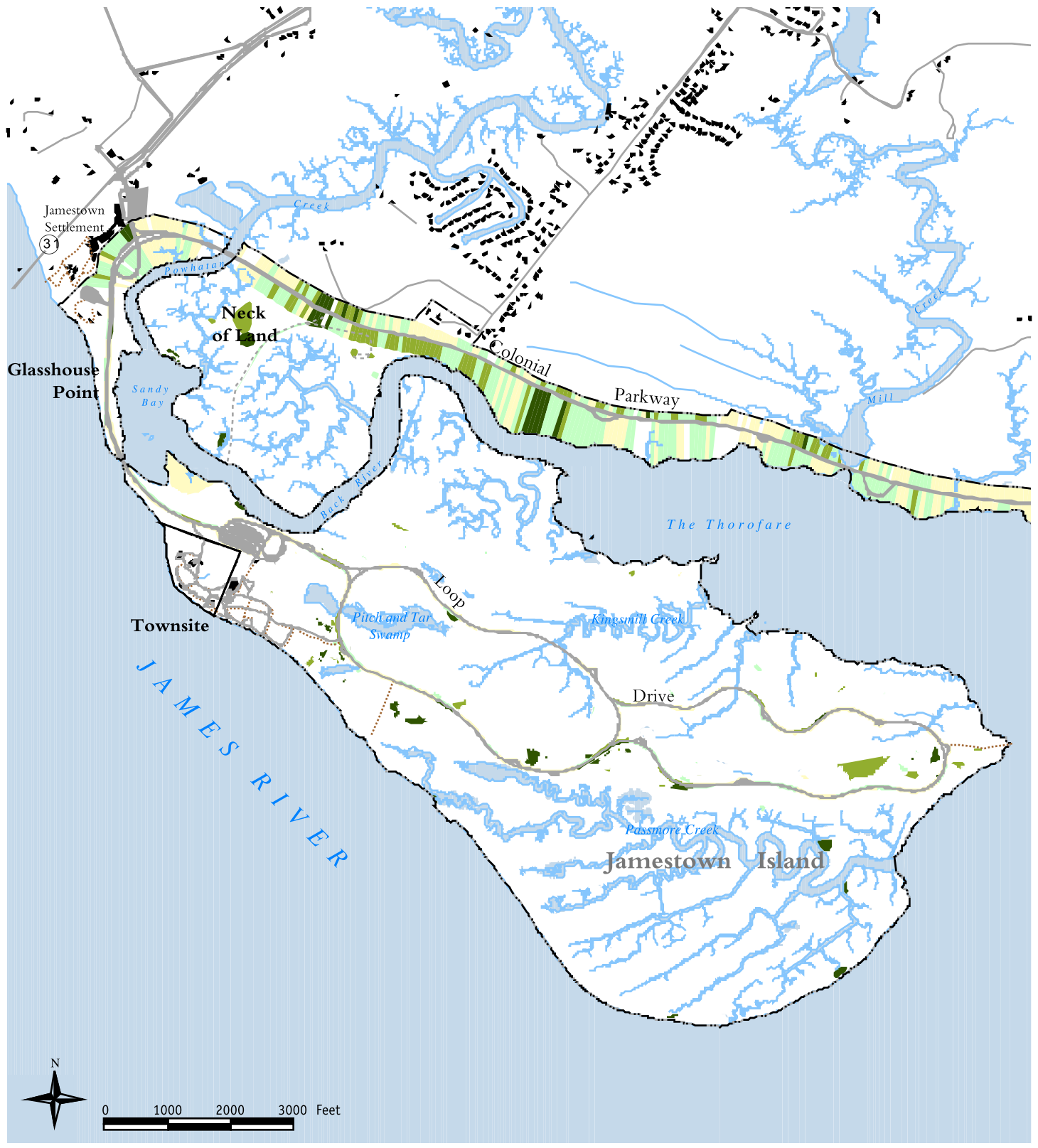
Legend

| | | | | | |
|---|---------------------------------------|---|----------------------------------|---|-------------------------|
|  | Developed Park and Interpretive Areas |  | Open Fields |  | Tidal Freshwater Marsh |
|  | Estuarine Fringe Pine Forest |  | Tidal Creeks and Ponds |  | Tidal Hardwood Swamp |
|  | Isolated Depressional Pond |  | Non-Riverine Swamp Forest |  | Tidal Oligohaline Marsh |
|  | Mesic Mixed Hardwood Forest |  | Non-Riverine Wet Hardwood Forest |  | Tidal Shrub Swamp |

Figure 3-17: Vegetative Cover Types

Note: Table 3-20 lists the corresponding National Vegetation Classification System designations.

Source: *Natural Communities of Virginia Classification of Ecological Community Types*, VDCR, 2001



Legend

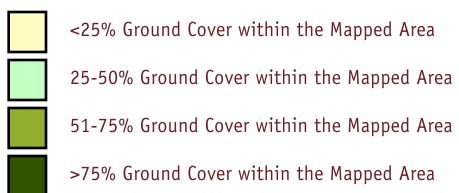


Figure 3-18: Invasive Exotic Plant Species

Source: *Final Report: Inventory of Invasive Exotic Plants of Colonial National Historical Park*, Gounaris & Grubbs, 2000

The National Park Service conducted an invasive exotic flora inventory of Colonial NHP beginning in April 1999. The results of the inventory were reported in *Final Report: Inventory of Invasive Exotic Plants of Colonial National Historical Park* (Gounaris and Grubbs 2000). The inventory included the following areas within Jamestown and the Colonial Parkway corridor: all forested areas and forested wetlands, all fields (Colonial Parkway only), and all nonforested wetlands. Mowed lawns of Jamestown Island (including the Townsite) were excluded from the inventory due to the difficulty of identifying species within those areas.

For the Jamestown Project area, exotic plant infestation is mostly concentrated along the Parkway and Loop Drive. Several smaller, isolated patches of heavy concentration (>51%) are located on the Island and Neck of Land areas (Figure 3-18). Overall, microstegium (*Microstegium viminium*) and Japanese honeysuckle (*Lonicera japonica*) are widespread throughout Jamestown and the rest of Colonial NHP. Parkwide, other species having a high percent ground cover include orchard grass (*Dactylis glomerata*), Bermuda grass (*Cynodon dactylon*), and tall fescue (*Festuca elatior*). However, if the large percentage of invasive coverage found on roadsides, trailsides and fields is removed, Chinese privet (*Ligustrum sinense*) is the most abundant species, followed by common chickweed (*Stellaria media*), common reed (*Phragmites australis*) and tree of heaven (*Ailanthus altissima*).

The following additional species were identified at Jamestown, including the Neck of Land area: aneilima (*Murdannia keisak*), beefsteak plant (*Perilla frutescens*), Canada bluegrass (*Poa compressa*), Chinese lespedeza (*Lespedeza cuneata*), English ivy (*Hedera helix*), gill over the ground (*Glechoma hederacea*), golden bamboo (*Phyllostachys aurea*), Japanese barberry (*Berberis thunbergii*), Johnson grass (*Sorghum halepense*), mimosa (*Albizzia julibrissin*), multiflora rose (*Rosa multiflora*), princess tree (*Paulonia tomentosa*), red sorrel (*Rumex acetosella*), velvet grass (*Holcus lanatus*), and wineberry (*Rubus phoenicolasius*).

The plants listed above were also identified in the Colonial Parkway corridor, except Japanese barberry. In addition to those, the following species were observed: autumn olive (*Elaeagnus umbellata*), Chinese wisteria (*Wisteria sinensis*), common dayflower (*Commelina communis*), crown vetch (*Coronilla varia*), kudzu (*Pueraria lobata*), moneywort (*Lysimachia nummularia*), morning glory spp. (*Ipomoea purpurea*, *coccinea*, and *hederacea*), oriental bittersweet (*Celastrus orbiculatus*), sweet-clover spp. (*Melilotus alba* and *officinalis*), thorny Elaeagnus (*Elaeagnus pungens*), white mulberry (*Morus alba*), and white poplar (*Populus alba*). It should be noted that reported results for the Colonial Parkway include the entire length of this road and not just the portion at Jamestown.

3.3.2.10 Wildlife

As compared to today, eastern Virginia in 1607, including the Jamestown Project area, was home to a wider diversity of animal species, as documented by the early settlers. John Smith (1612) recorded the presence of gray squirrels, flying squirrels, opossums, muskrats, hares (rabbit), bears, beavers, raccoons, otters, foxes, martens, polecats, wolves, weasels, minks, wildcats (possibly cougars), rats, and deer (with herds larger than 200). George Percy (1606) in the Williamsburg area noted “good pasture” for cattle and deer, both “red and fallow” probably in reference to white-tailed deer and elk. He also observed bears, foxes, otters, beavers, muskrats, and other “wild beasts unknown.” Thomas Hariot, in approximately 1588, noted similar species in his adventures along the coasts of North Carolina and Virginia. Samuel Argall in 1611 and John Lederer in 1668-70 recorded the presence of buffalo and elk along the York, Rappahannock, and Potomac Rivers; and Alexander Spotswood in 1716 similarly noted “herds of buffalo and elk feeding like cattle in pasture” when documenting his explorations in the Shenandoah Valley region. Little was recorded by the settlers about birds, reptiles, amphibians, and fishes, except that John Baniser between 1650 and 1692 recorded the presence of “black clouds” of pigeons (passenger

pigeons); Thomas Glover noted the then-plentiful sturgeon fish harvested from area rivers; and John Smith (1612) made mention of rattlesnakes and the wearing of snake rattles and live green snakes by American Indian men (Brownfeld and Mattozzi 2000).

In general, the wildlife population densities depend on many factors, including habitat availability, habitat quality for cover and nutritional food supplies, predator/prey relationships, climate, and human disturbance/interaction. To date, few terrestrial or arboreal wildlife census studies or measure of habitat quality have been assessed for the Jamestown study area. Some of the data available include annual neotropical migratory bird surveys; studies on the condition of the deer herd on NPS property; a study to determine the presence of state and federally listed rare, threatened, and endangered species within the project area (Chazal and Van Alstine 2001); and an inventory of reptiles and amphibians (Mitchell 2002). In addition, state and federal wildlife management agencies have performed fisheries studies, as discussed in the “Fisheries” section below.

Mammals

Eighty species of terrestrial mammals are known to exist in the Carolinas and Virginia (Webster et al. 1985), which comprises approximately two-thirds of the number of species estimated to occur in the region 10,000 years ago (McDonald et al. 1998). Webster et al. (1985) lists five extirpated species of mammals present before and during colonial times. These include the gray wolf, red wolf, porcupine, elk, and bison. Webster et al. (1985) believe the mountain lion (eastern cougar) still exists in western Virginia, although Linzey (1998) lists the mountain lion as an extirpated species.

No sightings of mountain lions have been verified in Virginia for decades. The release of cougar pets, confirmed by the presence of tattoos on the ears, has been an occasional occurrence. Similarly, since Webster et al.’s publication in 1985, bison have been domesticated in western Virginia.

The Jamestown Project study area offers a diversity of wetland and terrestrial habitat types for a variety of mammals. Of the 80 known species of mammals that occur in Virginia, the Virginia Department of Game and Inland Fisheries (VDGIF) has identified 42 species as potential residents of the Jamestown Island area (VDGIF 2000) based on confirmed sightings, habitat preference, and known species ranges (Table 3-21). All but one of the species listed in Table 3-21 have a global rarity rank of G5 (abundant). The northern long-eared myotis (*Myotis septentrionalis septentrionalis*) has global rarity rank of G4.

In addition, the mixture of wetland systems is an important source of habitat for several common mammals on the Island such as the raccoon, beaver, muskrat, and mink. Bats often frequent open water and field environments as hunting territories for insect prey. White-tailed deer, flying squirrels, gray squirrels, opossums, shrews, voles, cottontails, foxes, and rats are terrestrial species that potentially occupy the mowed fields and pine/hardwood upland forests. Raccoons, white-tailed deer, gray squirrels, mice, and Norway rats are species that have adapted to human-altered environments and may encroach upon yards, buildings, and storage areas in the study area (Snyder 1991).

Table 3-21: Potential Mammalian Wildlife Inhabitants of Jamestown Project Area

| Scientific Name | Common Name | Habitat Preference |
|---|-------------------------------|--|
| <i>Blarina brevicauda kirtlandi</i> | Kirtland's short-tailed shrew | Mostly terrestrial environments including salt marshes, fields, and forests. |
| <i>Castor canadensis</i> | Beaver | Wooded streams, ponds, lakes, and marshes. |
| <i>Cryptotis parva parva</i> | Least shrew | Relatively open areas dominated by herbaceous vegetation, such as grassy fields and salt marshes. |
| <i>Didelphis virginiana virginiana</i> | Virginia opossum | Wooded bottomlands near streams, ponds, swamps and other sources of water. |
| <i>Eptesicus fuscus fuscus</i> | Big brown bat | Abandoned buildings, attics, behind window shutters and under eaves. Hollow trees and crevices in rocks and under loose bark are also used to a lesser extent. |
| <i>Glaucomys volans volans</i> | Southern flying squirrel | Mature hardwood and mixed conifer hardwood forests, especially where there is an abundance of old trees with natural cavities or woodpecker holes suitable for nest-building. |
| <i>Lasionycteris noctivagans</i> | Silver-haired bat | Near permanent water in clumps of leaves, abandoned woodpecker holes, and protected crevices under loose bark in trees. Rock crevices and relatively open buildings sometimes serve as daytime roosts. |
| <i>Lasiurus borealis borealis</i> | Eastern red bat | Favored roost sites are trees and shrubs, often near permanent water or open fields. |
| <i>Lasiurus cinereus cinereus</i> | Hoary bat | Coniferous forests that border cleared areas and permanent water. |
| <i>Lynx rufus rufus</i> | Bobcat | A wide variety of habitats to include both coastal swamps and upland forests. Prefers forests where there are extensive areas of dense thickets associated land-clearing. |
| <i>Marmota monax monax</i> | Woodchuck | Prefers to dig a burrow on the edge of forests that border open land, along brushy fence rows or stream banks; also under building and the edge of utility easements. |
| <i>Mephitis mephitis nigra</i> | Striped skunk | Variety of habitats ranging from high mountain forests to old fields, cultivated lands, and suburban neighborhoods. |
| <i>Microtus pennsylvanicus pennsylvanicus</i> | Meadow vole | Damp meadows; also in coastal brackish and salt marshes, grassy upland fields, and orchards with a dense layer of herbaceous vegetation covering the ground. |
| <i>Microtus pinetorum pinetorum</i> | Common pine vole | A variety of woodland and old-field habitats, especially those with well-drained soil and either a deep layer of leaf litter or dense vegetation on the ground. |
| <i>Microtus pinetorum scalapoides</i> | Pine vole | Deciduous woods, grasslands, meadows, orchards. |
| <i>Mus musculus musculus</i> | House mouse | Houses, fields, farms. |
| <i>Mustela frenata noveboracensis</i> | Long-tailed weasel | Woodlands, brushy areas, and borders between woodlands and fields. |
| <i>Mustela vison mink</i> | Common mink | Semiaquatic; associated with most types of wetlands. |
| <i>Myotis lucifugus lucifugus</i> | Little brown bat | Attics of houses and buildings; under shingles and shutters; close proximity to permanent bodies of water. |
| <i>Myotis septentrionalis septentrionalis</i> | Northern long-eared myotis | Forested areas; hibernates in caves, mines, and tunnels. |
| <i>Nycticeius humeralis humeralis</i> | Evening bat | Hollow trees or in crevices under bark. |
| <i>Ochrotomys nuttalli nuttalli</i> | Common golden mouse | A variety of habitats, from moist woodlands and boulder-strewn slopes and ridges of the mountains to low thickets, swampy woodlands and canebrakes at lower elevations. |
| <i>Odocoileus virginianus</i> | White-tailed deer | Broken areas of mixed young forests, old fields, and croplands typical of much of the rural portions of the region. |

Table 3-21: Potential Mammalian Wildlife Inhabitants of Jamestown Project Area

| Scientific Name | Common Name | Habitat Preference |
|--|---------------------------|--|
| <i>Ondatra zibethicus macrodon</i> | Large-toothed muskrat | Brackish marshes dominated by bulrushes or cattails, but is likely present in most well-vegetated fresh or brackish marshes. |
| <i>Oryzomys palustris palustris</i> | Marsh rice rat | Fresh, brackish, and salt marshes and marsh edges. |
| <i>Peromyscus gossypinus gossypinus</i> | Cotton mouse | Lowland deciduous forests, cane and cypress swamps, thickets, and river floodplains. |
| <i>Peromyscus leucopus leucopus</i> | Common white-footed mouse | Hardwood forests preferred; field margins, myrtle thickets, marshes, canebrakes, and brushy fencerows are also inhabited. |
| <i>Pipistrellus subflavus subflavus</i> | Eastern pipistrelle | Spanish moss and clumps of leaves are used as daytime roosts; caves, rock crevices, and mines serve as hibernacula. |
| <i>Procyon lotor lotor</i> | Raccoon | Wetland habitats such as marshes, swamps, and streams but also occur in moist upland habitats and even in suburban neighborhoods. |
| <i>Rattus norvegicus norvegicus</i> | Norway rat | Lives in close proximity to humans; ground floor of buildings, tunnels, sewers, wharves, garbage dumps, and storage bins or elevators. |
| <i>Reithrodontomys humilis virginianus</i> | Eastern harvest mouse | Old fields, marshes, and meadows. |
| <i>Scalopus aquaticus aquaticus</i> | Eastern mole | Old field habitats. Likely to be found in broomsedge fields, but also in cultivated grain fields. |
| <i>Sciurus carolinensis carolinensis</i> | Gray squirrel | Extensive tracts of mature forests of oaks, hickories, and beeches mixed with other hardwoods and various species of conifers. |
| <i>Sciurus niger niger</i> | Southeastern fox squirrel | Longleaf pine-oak forests and along the edges of adjacent swamps in the Carolinas; Virginia sub-species may inhabit loblolly pine-hardwood forests with minimal undergrowth. |
| <i>Sigmodon hispidus virginianus</i> | Hispid cotton rat | Thick pastures, grassy roadsides, and abandoned agricultural fields dominated by broomsedge; also field edges with tangle of honeysuckle and other vines. |
| <i>Sorex hoyi winnemana</i> | Pygmy shrew | Ridges and slopes in deciduous forests with scattered rocks, fallen logs, and leaf litter covering the forest floor. |
| <i>Sorex longirostris longirostris</i> | Southeastern shrew | Damp fields, canebrakes, thickets, and lowland forests, particularly under the tangles of honeysuckle, poison ivy, and other vines. |
| <i>Sylvilagus floridanus mallurus</i> | Eastern cottontail | Old fields, brushy edges, and other habitats characterized by mixtures of herbaceous and shrubby plants. |
| <i>Tamias striatus fisheri</i> | Fisher's eastern chipmunk | Deciduous woodlands, the edges of forests, or open and brushy forests where there are abundant crevices for refuge. |
| <i>Urocyon cinereoargenteus cinereoargenteus</i> | Eastern gray fox | Strong preference for woodlands, especially those in the early stages of forest succession. |
| <i>Vulpes vulpes fulva</i> | Red fox | Open habitats, seldom found in dense woodlands; interspersed croplands, woodlots, and old fields. |
| <i>Zapus hudsonius americanus</i> | Meadow jumping mouse | Moist weedy or grassy fields and in thick vegetation near marshes, streams, or ponds. |

Reptiles/Amphibians

Mitchell (1994) records the presence of 62 species of reptiles in Virginia, of which 48 species are known to occur in the Coastal Plain. Forty-three reptilian species are cited as potential residents of the Jamestown study area (VDGIF 2000). Similarly, VDGIF itemizes 34 amphibian species as potential residents of the study area (Table 3-22).

Many species of frogs and salamanders are likely occupants of the hardwood swamps, marshes, and ditches in the study area, in addition to a variety of snakes and turtles such as the Northern water snake, eastern mud snake, Northern black racer, black rat snake, eastern mud turtle, eastern painted turtle, eastern snapping turtle, striped mud turtle, and northern red-bellied cooter. The tidal creeks and open water bodies formed from spoil dredging or created by beavers also offer excellent habitat for these species. In addition, many turtles and frogs frequent the Pitch and Tar Swamp, as seen from the pedestrian footbridge leading from the parking lot to the Visitor Center.

A site-specific herpetological survey was performed by Dr. Joseph Mitchell from the Department of Biology at the University of Richmond (Mitchell 2002). Using a variety of observation and trapping techniques, the results of his year-long study confirms the presence of 36 species of reptiles and amphibians in the Jamestown area. These include a variety of toads and treefrogs, salamanders, skinks, snakes, and turtles. No listed species were observed.

Some of the more common species observed in Dr. Mitchell's study include the green treefrog, Northern green frog, Southern leopard frog, marbled salamander, red-backed salamander, red-spotted newt, common snapping turtle, Eastern

painted turtle, Eastern box turtle, Eastern mud turtle, five-lined skink, worm snake, and Northern water snake. Preferred habitats for most frogs include the ponds and vernal forested depressions on the island, whereas most salamanders were observed in the deciduous and pine forests. Water-loving turtles such as the common snapping turtle, Eastern painted turtle, spotted turtle, and Eastern mud turtle were observed occupying the ponds and vernal depressions on the island. The Eastern box turtle was the most common species observed in the forested uplands, and the Northern diamond-backed terrapin was the only species of turtle to be found exclusively in the tidal marsh.

Most all snakes and lizards were observed in the forested upland habitats, with the exception of the Northern watersnake, which was commonly observed in areas of open water and was the only species of snake observed in the tidal marsh.

Dr. Mitchell's inventory of reptiles and amphibians revealed very little usage of what he classified as "bottomland hardwood" habitat. This is primarily due to the very small amount of this particular habitat type. The most commonly used habitat types were the ponds/vernal pools and upland pine forests. The island tended to harbor a higher number of species than the Neck of Land due to the higher quality habitat and more frequent presence of wetlands with open water (ponds and vernal pools).

Table 3-22 is a list of all the potential species that may inhabit the project area. All but one of the species listed in Table 3-22 have a global rarity rank of G5 (abundant). The northern diamond-backed terrapin (*Malaclemys terrapin terrapin*) is listed as G4.

Table 3-22: Potential Amphibian and Reptilian Inhabitants of Jamestown Project Area

| Scientific Name | Common Name | Preferred Habitat |
|---|-------------------------------|---|
| <i>Acris crepitans crepitans</i> | Eastern cricket frog | Upland areas in the Northern U.S. |
| <i>Acris gryllus gryllus</i> | Coastal plain cricket frog | Lowlands, Coastal Plain bogs and ponds and river-bottom swamps. |
| <i>Agkistrodon contortrix mokasen</i> | Northern copperhead | Rocky, wooded hillsides and mountainous areas; abandoned and rotting slab or sawdust piles. |
| <i>Agkistrodon piscivorus piscivorus</i> | Eastern cottonmouth | Swamps, lakes, and rivers, of rice fields and ditches. |
| <i>Ambystoma maculatum</i> ¹ | Spotted salamander | Beneath stones or boards in moist environments; breeds in woodland ponds. |
| <i>Ambystoma opacum</i> ¹ | Marbled salamander | Moist sandy areas to dry hillsides. |
| <i>Amphiuma means</i> ¹ | Two-toed amphiuma | Ditches, sloughs, ponds, rice fields, swamps, streams. |
| <i>Bufo americanus</i> ¹ | American toad | Shallow bodies of water in which to breed, hiding places where there is some moisture, and an abundant supply of insects and other invertebrates for food. |
| <i>Bufo fowleri</i> ¹ | Fowler's toad | Chiefly in sandy areas, around shores of lakes, or in river valleys. |
| <i>Bufo terrestris</i> | Southern toad | Particularly abundant in sandy areas. |
| <i>Carphophis amoenus amoenus</i> ¹ | Eastern worm snake | Usually discovered under stones or boards, in rotting logs, during digging operations. |
| <i>Cemophora coccinea copei</i> | Northern scarlet snake | In or near soil suitable for burrowing (sandy, loamy, etc.), in logs, beneath bark, etc. |
| <i>Chelydra serpentina serpentina</i> ¹ | Eastern snapping turtle | Any permanent body of fresh water. |
| <i>Chrysemys picta picta</i> ¹ | Eastern painted turtle | Shallow water with profuse aquatic vegetation and the bottom soft and muddy. |
| <i>Clemmys guttata</i> ¹ | Spotted turtle | Marshy meadows, bogs, swamps, small ponds, ditches, or other shallow bodies of water. |
| <i>Cnemidophorus sexlineatus sexlineatus</i> | Six-lined racerunner | Open, well-drained areas are preferred – those covered with sand or loose soil; fields, open woods, thicket margins, rocky outcrops, river floodplains. |
| <i>Coluber constrictor constrictor</i> ¹ | Northern black racer | Wet or dry woods, farms, fields, swamps. |
| <i>Desmognathus auriculatus</i> | Southern dusky salamander | Mucky and acidic cypress ponds, stagnant to slightly stagnant pools in river floodplains and coastal swamps. |
| <i>Desmognathus fuscus</i> | Northern dusky salamander | Brooks, streams and seepage areas. |
| <i>Diadophis punctatus edwardsii</i> | Northern ringneck snake | Cutover areas that include an abundance of hiding places in the form of stones, logs, bark slabs, or other rotting wood. |
| <i>Diadophis punctatus punctatus</i> ¹ | Southern ringneck snake | Although not aquatic, ringnecks are most often found where there are evidences of moisture—near swamps, springs, on damp wooded hillsides, in flat, poorly-drained pine woods, etc. |
| <i>Elaphe guttata</i> | Corn snake | Terrestrial habitats—in pine barrens or wood lots, on rocky hillsides; spends a lot of time underground. |
| <i>Elaphe obsoleta obsoleta</i> ¹ | Black rat snake | Habitats range from rocky, timbered hillsides to flat farmlands or the Coastal Plain. May establish residence in tree cavities. |
| <i>Eumeces fasciatus</i> ¹ | Five-lined skink | A great variety of habitats but able to tolerate drier conditions. Thrives mainly on small seashore islands in the southeast that have no fresh water and little vegetation. |
| <i>Eumeces inexpectus</i> | Southeastern five-lined skink | Found in a great variety of habitats but able to tolerate drier conditions. Thrives mainly on small seashore islands in the southeast that have no fresh water and little vegetation. |
| <i>Eumeces laticeps</i> ¹ | Broadhead skink | Habitats vary from swamp forests to empty urban lots strewn with debris. |
| <i>Eurycea cirrigera</i> | Southern two-lined salamander | Beneath masses of wet leaves in creek or river swamps. |
| <i>Eurycea guttolineata</i> | Three-lined salamander | River-bottom swamps, wet ditches, seepage areas at springs and streamsides. |
| <i>Farancia abacura abacura</i> | Eastern mud snake | Southern swamps and lowlands. |

Table 3-22: Potential Amphibian and Reptilian Inhabitants of Jamestown Project Area

| Scientific Name | Common Name | Preferred Habitat |
|---|----------------------------------|--|
| <i>Farancia erythrogramma erythrograma</i> | Rainbow snake | Found in or near water; streams passing through cypress swamps. |
| <i>Gastrophryne carolinensis</i> ¹ | Eastern narrow-mouthed toad | A wide variety of habitats with shelter and moisture. |
| <i>Hemidactylium scutatum</i> ¹ | Four-toed salamander | Usually associated with sphagnum as well as boggy woodland ponds. |
| <i>Heterodon platirhinos</i> | Eastern hognose snake | Sandy areas. |
| <i>Hyla chrysoscelis</i> ¹ | Cope's gray treefrog | Chiefly in relatively small trees or shrubs that are near or actually standing in shallow bodies of water. |
| <i>Hyla cinerea</i> ¹ | Green treefrog | Swamps, borders of lakes and streams, floating vegetation, or almost any place well supplied with water or dampness. |
| <i>Hyla femoralis</i> | Pine woods treefrog | Climbs high in the trees, commonly found in pine flatwoods and in or near cypress swamps. |
| <i>Hyla squirella</i> ¹ | Squirrel treefrog | Found in gardens, weed or brush tangles, woods, trees, vines-anywhere close to moisture. |
| <i>Kinostemon baurii</i> | Striped mud turtle | Deep drainage canals, sloughs, ponds, and "lettuce" lakes in cypress swamps to wet meadows, ditches, and other small, shallow bodies of water. |
| <i>Kinostemon subrubrum subrubrum</i> ¹ | Eastern mud turtle | Shallow water areas such as ditches, wet meadows, small ponds, marshes, etc. |
| <i>Lampropeltis triangulum triangulum</i> | Eastern milk snake | Fields, woodlands, rocky hillsides, river bottoms, etc. |
| <i>Lampropeltis calligaster rhombomaculata</i> | Mole kingsnake | Thickets, woodlots, cultivated fields, and even back yards in some suburban areas. |
| <i>Lampropeltis getula getula</i> | Eastern kingsnake | Chiefly terrestrial, but shows a distinct liking for streambanks and borders of swamps. |
| <i>Malaclemys terrapin terrapin</i> ² | Northern Diamond-backed terrapin | Coastal marshes, tidal flats; prefers estuaries and lagoons behind barrier beaches. |
| <i>Nerodia erythrogaster erythrogaster</i> | Red-bellied water snake | River swamps and numerous other aquatic habitats of the Southeast. |
| <i>Nerodia sipedon sipedon</i> ¹ | Northern water snake | Resident of virtually every swamp, marsh, or bog, of every stream, pond, or lake border within its range. |
| <i>Nerodia taxispilota</i> | Brown water snake | Clear, quiet waters; resident of great rivers and swamps of the south. |
| <i>Notophthalmus viridescens viridescens</i> ¹ | Red-spotted newt | Ponds, small lakes, marshes, ditches, quiet portions of streams, or other permanent or semi-permanent bodies of unpolluted water. |
| <i>Opheodrys aestivus aestivus</i> ¹ | Rough green snake | Frequent habitat includes brushy areas overhanging a stream or lake border. |
| <i>Ophisaurus attenuatus longicaudus</i> | Eastern slender glass lizard | Dry grasslands or dry, open woods. |
| <i>Plethodon chlorobryonis</i> ¹ | Atlantic coast slimy salamander | Moist woodland ravines or hillsides. |
| <i>Plethodon cinereus</i> ¹ | Northern red-backed salamander | Terrestrial, more or less wooded areas beneath logs, stones, bark, etc. |
| <i>Pseudacris brimleyi</i> | Brimley's chorus frog | Marshes, swamps, ditches, and wet open woods of the Coastal Plain. |
| <i>Pseudacris crucifer crucifer</i> ¹ | Northern spring peeper | Especially abundant in second growth brushy areas or cutover woodlots, if these are small temporary or semi-permanent ponds or swamps. |
| <i>Pseudacris feriarum</i> | Southeastern chorus frog | Grassy swales, moist woodlands, river-bottom swamps, and environs of ponds, bogs, and marshes. Upland in North, Lowland in South. |
| <i>Pseudacris ocularis</i> | Little grass frog | Grassy environs of ponds and cypress bays. |
| <i>Pseudemys rubriventris rubriventris</i> | Northern red-bellied cooter | Ponds, rivers, and, in general, relatively large bodies of fresh water. |
| <i>Pseudotriton montanus montanus</i> | Eastern mud salamander | Muddy environs of springs, muddy seeps along small streams. |

Table 3-22: Potential Amphibian and Reptilian Inhabitants of Jamestown Project Area

| Scientific Name | Common Name | Preferred Habitat |
|--|----------------------------|--|
| <i>Pseudotriton ruber ruber</i> | Northern red salamander | Under moss, stones near springs or rills, provided that the water is not stagnant. Streams that flow through open fields, woods (sand, gravel, or rock bottom). |
| <i>Rana catesbeiana</i> ¹ | Bullfrog | Lakes, ponds, bogs, sluggish portions of streams, cattle tanks. |
| <i>Rana clamitans melanota</i> ¹ | Southern green frog | Abundant wherever there is shallow fresh water-- springs, rills, creeks, and ditches. Also common in brooks and small streams. |
| <i>Rana palustris</i> | Pickereel frog | Typically a species of cool, clear water in the North--sphagnum bogs, rocky ravines, and meadow streams. |
| <i>Rana sphenoccephala utricularius</i> ¹ | Southern leopard frog | All types of freshwater habitats, and even entering slightly brackish marshes along coasts. |
| <i>Regina rigida rigida</i> | Glossy crayfish snake | Aquatic, habitat similar to that of the Swamp Snakes. |
| <i>Scaphiopus holbrookii</i> ² | Eastern spadefoot | Areas characterized by sandy or other loose soil. |
| <i>Sceloporus undulatus hyacinthinus</i> | Northern fence lizard | Often seen on rail fences or on rotting logs or stumps. |
| <i>Scincella lateralis</i> ¹ | Little brown skink | On the woodland floor. Likely to appear anywhere in the deep south, even in towns and gardens. |
| <i>Siren lacertina</i> | Greater siren | Ditches, weed-choked or muddy ponds, rice fields, streams with clear or turbid water, lakes. |
| <i>Stereochilus marginatus</i> | Many-lined salamander | Pools and sluggish streams in swampy woodlands. |
| <i>Sternotherus odoratus</i> | Eastern musk turtle | Shallow, clear-water lakes, ponds and rivers. |
| <i>Storeria dekayi dekayi</i> ² | Northern brown snake | Enviorns of bogs, swamps, freshwater marshes, moist woods, hillsides, etc. |
| <i>Storeria occipitomaculata occipitomaculata</i> | Northern red-bellied snake | Abundant in many mountainous or upland parts of the northeast. Often found in or near open woods, but also occurring in sphagnum bogs from sea level to high in the mountains. |
| <i>Terrapene carolina carolina</i> | Eastern box turtle | Terrestrial species that is found under logs or rotting vegetation. |
| <i>Thamnophis sauritus sauritus</i> | Eastern ribbon snake | Streams, ponds, bogs, or swamps. |
| <i>Thamnophis sirtalis sirtalis</i> ¹ | Eastern garter snake | Meadows, marshes, woodlands, hillsides, along streams and drainage ditches, and sometimes even in city lots, parks, and cemeteries if pollution is not too severe. |
| <i>Trachemys scripta elegans</i> | Red-eared slider | Quiet water with a muddy bottom and a profusion of vegetation. |
| <i>Trachemys scripta scripta</i> | Yellowbellied slider | Rivers, ditches, sloughs, lakes, and ponds. |
| <i>Virginia striatula</i> | Rough earth snake | Seldom appears above ground. |
| <i>Virginia valeriae valeriae</i> | Eastern smooth earth snake | Abandoned fields and enviorns of trails and back roads, especially those in or near deciduous forests. |

Notes: 1-Species cited by VDGIF database and observed by Mitchell (2002).

2-Species observed by Mitchell (2002) and not cited by VDGIF database as a potential resident.

Birds

The Jamestown Project area contains important habitat for regional and migratory avifauna. The wetland, riverine, open field, and forested oak/pine complexes provide the diversity necessary to host a variety of passerines, buteos, accipiters, waterfowl, wading birds, woodpeckers, and shorebirds. As part of the Atlantic flyway, the Island is particularly

important for wintering and breeding migratory species that use the habitats during all seasons. For example, the area marshes and surrounding waters provide wintering habitat for waterfowl; upland forests and wetland scrub areas offer breeding and foraging habitat for neotropical species during the spring/summer; and, all habitats are used by year-round residents such as crows, jays, wading birds,

cardinals, and owls. Several resident Canada geese have been observed nesting in a beaver pond in the Pitch and Tar Swamp.

The area's marshes, rivers, tidal creeks, and beaver ponds offer the most significant habitat for migratory and resident birds. The richness of this habitat provides excellent nesting, brooding, foraging, and roosting areas, particularly for the bald eagle. The study area currently is host to three bald eagle nest sites, as described in the "Rare, Threatened, and Endangered Species" section of this document, and wading bird rookeries have been recorded in the eastern portion of the Island. These rookeries are occupied mainly by great blue herons (estimated at more than 200 nests in 1998) and are located in the pine wetlands (PF04R) that narrowly extend out across Passmore Creek.

The National Park Service has hosted annual neotropical bird counts on Jamestown Island each June, the results of which have consistently yielded 66 to 68 species observed. However, these surveys are performed when wintering migrants would not be detected. The Virginia Department of Game and Inland Fisheries has prepared a more comprehensive list of 189 species of birds that potentially use the Island at various times of the year. In addition to the VDGIF list, Dr. Bryan Watts reviewed the potential avifauna at Jamestown, and the results of his study yielded 48 additional species of birds that may potentially use the project site (Table 3-23). Of the total list, 88 are winter migrants, 75 are year-round residents, and 74 are migrant breeders.

Birds of Special Concern

The following birds are listed as watch-list species by either the state of Virginia or the federal government. Information pertaining to the bald eagle is covered under "Rare, Threatened, and Endangered Species."

Least Bittern. The least bittern is a small, cryptic heron with conspicuous buff wing patches. It prefers freshwater marshes with reeds along the

edges of open water, where it forages primarily on aquatic invertebrates. Within North America, the bittern ranges from southern Canada to southern Texas, and winters from the Gulf Coast southward. The marshes and open water ponds on Jamestown Island and Neck of Land provide adequate habitat for the least bittern, the numbers of which are unknown.

Great Blue Heron. The great blue heron is currently not a state or federal listed species; however, it is listed in the state of Virginia as a "watch list" species, and waterbird colonies containing the great blue heron are monitored by the FWS and VDGIF (VDGIF 2001). The great blue heron is a large, grayish, wading bird with a yellowish bill. It is common throughout the Southeast and Midwest United States where it can be found around lakes, ponds, rivers, and coastal marshes. It is a colonial, tree-nesting species, often nesting in association with other wading birds within rookeries. Its preferred food source includes amphibians and fish generally found in shallow water.

Three great blue heron rookeries, all near one another, were discovered in 1984 on the southeast side of Jamestown Island between Passmore Creek and the James River. Nests occupy large loblolly pines that overlook the Passmore Creek marsh. These rookeries have been routinely monitored over the years, and the breeding pairs have seen fluctuation in their numbers. At last estimate in 1997, the number of nesting pairs was approximately 220 (Center for Conservation Biology 1998).

The Jamestown Island colony lies directly across the James River from a similar colony on Hog Island Wildlife Management Area, and the two colonies appear to share foraging areas and birds, with their numbers varying each year accordingly. The Hog Island rookery had also historically contained great egret nests, though data has been unavailable for the site for the past several years (Center for Conservation Biology 1998).

Great Egret. The great egret is a large, white heron with a yellow bill and black legs. Habitat preferences include freshwater and saltwater marshes, ponds, lakes, and tidal flats. It ranges as far north as New England during the summer months, with the dominant winter range extending from South Carolina southward and along the Gulf Coast. Preferred food sources include fish, amphibians, small reptiles, and crustaceans.

Habitats on Jamestown Island include the marshes, inland creeks, and open-water ponds, though there are no known great egret nests on the Island (Center for Conservation Biology 1998). Management recommendations to protect potential habitat for the great egret include protection of the marshes and tidal creeks, and ensuring the water quality of the rivers and ponds is maintained to provide excellent foraging habitat.

Northern Harrier. The northern harrier is a medium sized hawk that is recognized by its white rump patch and low, gliding flight pattern over its preferred habitat of marshes, open fields, and farms. This is the only hawk that hunts from the wing rather than from the perch. Prey includes small mammals, birds, and reptiles. The northern harrier's breeding range extends from north-central United States and Canada, while the wintering habitat includes the East Coast states, south-central United States, and Gulf states.

Habitat for the harrier on Jamestown Island includes the open marshes of Passmore Creek, Back River, Powhatan Creek, and Pitch and Tar Swamp. Upland mowed fields provide some limited habitat.

Barn Owl. The barn owl is a large nocturnal raptor that prefers quiet, open sites for nesting such as abandoned/unoccupied structures (barns, church steeples, vacant houses). Nest sites are often near feeding areas that comprise open farm fields and clearings with hedgerows and fence rows. Prey includes primarily small mammals, particularly voles.

The barn owl can be found across most regions of the world. In North America, its range includes most of temperate region from southern Canada into Mexico.

It appears the availability of hedge rows, fence rows, and field edges for barn owl habitat at Jamestown Island is limited to those around the Townsite and along the mowed fields/yards around the maintenance center on Colonial Parkway.

Caspian Tern. The Caspian tern is a mostly white, gull-sized bird with a black cap and pale gray back and wings. Its bill is very bright red. The Caspian tern's habitat includes sandy shores of lakes, ponds, large rivers, and the sea coast where it can be found from the Great Lakes region and the Newfoundland area of Canada southward to wintering grounds in the Carolinas and Gulf Coast. Breeding habitat often corresponds with other colonial nesting shorebirds.

Habitat for the Caspian tern at Jamestown Island appears to be limited to the feeding areas associated with open water, such as the James River, Back River, The Thorofare, and Sandy Bay. No habitat for nesting appears suitable for the Caspian tern within the project area.

Least Tern. The least tern is the smallest of the terns, about the size of a sparrow. It is noted by its yellow bill with black cap. It is a colonial nester, and prefers open beaches, sand dunes, and large river sandbars for nesting. This bird occurs along most North American coastlines and large rivers. Concern for the species has been raised due to the increased use of shoreline and waterfront for development, which has reduced nesting habitat.

The Jamestown Project area does not maintain any colonial, ground nesting sites that would include the least tern. It appears use of the area by least terns is limited to feeding areas within the rivers and open water.

Table 3-23: Potential Avifaunal Inhabitants of Jamestown Project Area

| Scientific Name | Common Name | Preferred Habitat |
|--|-----------------------------|--|
| <i>Accipiter cooperii</i> | Cooper's hawk | Deciduous and coniferous forests near clearings. |
| <i>Accipiter striatus velox</i> | Sharp-shinned hawk | Coniferous forests, less often in deciduous forests. |
| <i>Actitis macularia</i> | Spotted sandpiper | Wooded and open areas near water. |
| <i>Agelaius phoeniceus</i> | Red-winged blackbird | Marshes |
| <i>Aix sponsa</i> | Wood duck | Marshes, forested swamps, lakes, ponds. |
| <i>Ammodramus caudacutus</i> | Sharp-tailed sparrow | Edges of salt water and freshwater marshes |
| <i>Ammodramus maritimus</i> | Seaside sparrow | Exclusively salt marshes with pockets of open water |
| <i>Ammodramus savannarum pratensis</i> | Grasshopper sparrow | Open fields, meadows |
| <i>Anas acuta acuta</i> | Northern pintail | Marshes, open water |
| <i>Anas americana</i> | American widgeon | Marshes, open water |
| <i>Anas clypeata</i> | Northern shoveler | Marshes, open water |
| <i>Anas crecca carolinensis</i> | Green-winged teal | Marshes, open water, ponds, lakes |
| <i>Anas discors</i> | Blue-winged teal | Marshes, open water, ponds, lakes |
| <i>Anas penelope</i> | Eurasian widgeon | Marshes, open water, ponds, lakes |
| <i>Anas platyrhynchos</i> | Mallard | Lakes, ponds, swamps, marshes |
| <i>Anas rubripes</i> | American black duck | Lakes, ponds, swamps, marshes |
| <i>Anas strepera</i> | Gadwall | Lakes, ponds, swamps, marshes |
| <i>Anser albifrons flavirostris</i> | Greater white-fronted goose | Lakes, ponds, marshes, open fields |
| <i>Anthus rubescens</i> | American pipit | Beaches, barren lands, agricultural fields, and golf courses |
| <i>Archilochus colubris</i> | Ruby-throated hummingbird | Gardens, parks, woodlands |
| <i>Ardea alba</i> | Great egret | Marshes, ponds, lakes, ditches |
| <i>Ardea herodias herodias</i> | Great blue heron | Marshes, ponds, lakes, ditches |
| <i>Asio flammeus</i> | Short-eared owl | Marshes, grasslands, prairies |
| <i>Aythya affinis</i> | Lesser scaup | Marshes, open water, ponds, lakes |
| <i>Aythya americana</i> | Redhead | Marshes, open water, ponds, lakes |
| <i>Aythya affinis</i> | Lesser scaup | Marshes, open water, ponds, lakes |
| <i>Aythya americana</i> | Redhead | Marshes, open water, ponds, lakes |
| <i>Aythya collaris</i> | Ring-necked duck | Marshes, open water, ponds, lakes |
| <i>Aythya marila</i> | Greater scaup | Marshes, open water, ponds, lakes |
| <i>Aythya valisineria</i> | Canvasback | Marshes, open water, ponds, lakes |

Table 3-23: Potential Avifaunal Inhabitants of Jamestown Project Area

| Scientific Name | Common Name | Preferred Habitat |
|-------------------------------------|------------------------|---|
| <i>Baeolophus bicolor</i> | Tufted titmouse | Swamp or moist woodlands, shade trees in cities and parks |
| <i>Bartramia longicauda</i> | Upland sandpiper | Open grasslands, meadows, fields |
| <i>Bombycilla cedrorum</i> | Cedar waxwing | Open woodlands, orchards |
| <i>Botaurus lentiginosus</i> | American bittern | Marshes, lake shores |
| <i>Branta canadensis</i> | Canada goose | Open water, lakes, marshes, fields, meadows |
| <i>Bubo virginianus</i> | Great-horned owl | Deciduous and coniferous forests, swamps, city parks |
| <i>Bubo virginianus</i> | Great horned owl | Open forests, swamps, urban parks |
| <i>Bubulcus abis</i> | Cattle egret | Open fields near open water |
| <i>Bucephala albeola</i> | Bufflehead | Lakes, ponds, marshes |
| <i>Bucephala clangula americana</i> | Common goldeneye | Marshes, bays, inlets |
| <i>Buteo jamaicensis</i> | Red-tailed hawk | Deciduous forests and open fields |
| <i>Buteo lagopus johannis</i> | Rough-legged hawk | Marshes, open fields,, farms |
| <i>Buteo lineatus lineatus</i> | Red-shouldered hawk | Deciduous forests, especially with standing water |
| <i>Buteo platypterus</i> | Broad-winged hawk | Deciduous woodlands |
| <i>Butorides virescens</i> | Green heron | Lake margins, streams, ponds, marshes |
| <i>Calidris alba</i> | Sanderling | Beaches, sandbars, mudflats, inland lakes |
| <i>Calidris alpina hudsonia</i> | Dunlin | Beaches, sandbars, mudflats, inland lakes |
| <i>Calidris himantopus</i> | Stilt sandpiper | Grassy pools, pond shores |
| <i>Calidris melanotos</i> | Pectoral sandpiper | Wet, short-grass areas; grassy pools; golf courses and airports after heavy rains; and salt creeks and meadows. |
| <i>Calidris pusilla</i> | Semipalmated sandpiper | Coastal beaches, lake and river shores, flats, and pools in salt marshes |
| <i>Calidris minutilla</i> | Least sandpiper | Grassy pools, bogs, flooded fields |
| <i>Caprimulgus carolinensis</i> | Chuck-will's widow | Open woodlands, clearings, farms |
| <i>Caprimulgus vociferus</i> | Whip-poor-will | Open woodlands, clearings, farms |
| <i>Cardinalis cardinalis</i> | Northern cardinal | Woodlands, thickets, brushy swamps |
| <i>Carduelis flammea</i> | Common redpoll | Brushy pastures, weedy fields as winter habitat |
| <i>Carduelis pinus</i> | Pine siskin | Mixed and coniferous woods, brushy pastures |
| <i>Carduelis tristis</i> | American goldfinch | Brushy thickets, grasslands |
| <i>Carpodacus mexicanus</i> | House finch | Cities and residential areas |
| <i>Carpodacus purpureus</i> | Purple finch | Mixed and coniferous woodlands; ornamental conifers in gardens |
| <i>Cathartes aura</i> | Turkey vulture | Deciduous forests and woodlands, farm fields |
| <i>Catharus fuscescens</i> | Veery | Moist deciduous woodlands; willow thickets along streams and thickets in winter |

Table 3-23: Potential Avifaunal Inhabitants of Jamestown Project Area

| Scientific Name | Common Name | Preferred Habitat |
|--|--------------------------------------|--|
| <i>Catharus guttatus</i> | Hermit thrush | Coniferous and mixed forests; deciduous woodlands and thickets in winter. |
| <i>Catharus minimus</i> | Gray-cheeked thrush | Nests in coniferous forests and willow thickets |
| <i>Catharus ustulatus</i> | Swainson's thrush | Coniferous forests and willow thickets |
| <i>Certhia familiaris</i> | Brown creeper | Deciduous and mixed woodlands |
| <i>Ceryle alcyon</i> | Belted kingfisher | Rivers, lakes, and saltwater estuaries |
| <i>Chaetura pelagica</i> | Chimney swift | Breeds and roosts in chimneys |
| <i>Charadrius semipalmatus</i> | Semipalmated plover | Beaches and tidal flats, shallow pools in salt marshes; lakeshores in the interior during migration |
| <i>Charadrius vociferus</i> | Killdeer | Open country generally; plowed fields, golf courses, and short-grass prairies |
| <i>Chen caerulescens caerulescens</i> | Lesser snow goose | Breeds on the tundra and winters in salt marshes and marshy coastal bays |
| <i>Chen caerulescens atlanticus</i> | Snow goose | Breeds on the tundra and winters in salt marshes and marshy coastal bays |
| <i>Chordeiles minor</i> | Common nighthawk | Aerial, but open country generally; also cities and towns |
| <i>Circus cyaneus</i> | Northern harrier (Marsh hawk) | Marshes and open grasslands |
| <i>Cistothorus palustris</i> | Marsh wren | Fresh and brackish marshes with cattails, reeds, bulrushes, or sedges |
| <i>Cistothorus platensis</i> ¹ | Sedge wren (short-billed marsh wren) | Grassy freshwater marshes and sedges; also brackish marshes and wet meadows in winter |
| <i>Clangula hyemalis</i> | Oldsquaw | Tundra; in winter on open bays and inshore waters |
| <i>Coccothraustes vespertinus</i> | Evening grosbeak | Nests in coniferous forests; visits deciduous woodlands and suburban areas in winter |
| <i>Coccyzus americanus</i> | Yellow-billed cuckoo | Moist thickets, willows, overgrown pastures, and orchards |
| <i>Coccyzus erythrophthalmus</i> | Black-billed cuckoo | Moist thickets in low, overgrown pastures and orchards, but occurs in thicker undergrowth and in sparse woodland |
| <i>Colaptes auratus</i> | Northern flicker | Open country with trees; parks and rural estates |
| <i>Colinus virginianus</i> | Northern bobwhite | Pastures, grassy roadsides, and farmlands |
| <i>Columba livia</i> | Rock dove | City parks, suburban gardens, and farmland |
| <i>Contopus virens</i> | Eastern wood pewee | Forest, open woodland, orchards, and shade trees in parks and along roadsides |
| <i>Coragyps atratus</i> | Black vulture | Open country wherever carrion is present |
| <i>Corvus brachyrhynchos</i> | American crow | Woodlands, farmland, and suburban areas |
| <i>Corvus ossifragus</i> | Fish crow | Low coastal country, near tidewater in the north; in the south also lakes, rivers, and swamps far inland |
| <i>Cyanocitta cristata</i> | Blue jay | Chiefly oak forest, but now also city parks and suburban yards, especially where oak trees predominate |
| <i>Cygnus columbianus columbianus</i> | Tundra swan | Lakes, ponds, freshwater and brackish marshes with open water |
| <i>Cygnus olor</i> | Mute swan | Ponds, rivers, coastal lagoons, and bays |
| <i>Dendrocygna bicolor</i> | Fulvous whistling-duck | Ponds, coastal marshes, bays |
| <i>Dendroica caerulescens</i> ¹ | Black-throated blue warbler | Mixed deciduous and evergreen |
| <i>Dendroica castanea</i> ¹ | Bay-breasted warbler | Breeds in open spruce forests. During migration frequents deciduous trees as well. |

Table 3-23: Potential Avifaunal Inhabitants of Jamestown Project Area

| Scientific Name | Common Name | Preferred Habitat |
|--|------------------------------|---|
| <i>Dendroica cerulea</i> ¹ | Cerulean warbler | Open woodland, often near streams and rivers |
| <i>Dendroica coronata comata</i> | Yellow-rumped warbler | Coniferous and mixed forests; widespread during migration and winter |
| <i>Dendroica discolor</i> | Prairie warbler | Open scrub in the south |
| <i>Dendroica dominica</i> | Yellow-throated warbler | Forests of pine, cypress, sycamore, and oak, in both swampy places and dry uplands |
| <i>Dendroica fusca</i> ¹ | Blackburnian warbler | Most numerous in mixed forests of hemlock, spruce, and various hardwoods, usually ranging high in the trees |
| <i>Dendroica magnolia</i> ¹ | Magnolia warbler | Breeds in open stands of young spruce and fir. In migration is found almost any place where shrubbery or trees occur. |
| <i>Dendroica palmarum</i> | Palm warbler | Open places, especially weedy fields and borders of marshes |
| <i>Dendroica pensylvanica</i> ¹ | Chestnut-sided warbler | Young, open, second-growth woodland and scrub. |
| <i>Dendroica petechia</i> | Yellow warbler | Moist thickets, especially along streams and in swampy areas; gardens |
| <i>Dendroica pinus</i> | Pine warbler | Pine forests |
| <i>Dendroica striata</i> | Blackpoll warbler | Breeds in coniferous forests. During migration is found chiefly in tall trees |
| <i>Dendroica tigrina</i> ¹ | Cape May warbler | Open spruce forests; in migration, in evergreen or deciduous woodlands and often in parks, estates, or suburban yards |
| <i>Dendroica virens</i> ¹ | Black-throated green warbler | Open stands of hemlock or pine; in migration in a variety of habitats. |
| <i>Dolichonyx oryzivorus</i> ¹ | Bobolink | Prairies and meadows; marshes during migration. |
| <i>Dryocopus pileatus</i> | Pileated woodpecker | Dense forest and borders |
| <i>Dumetella carolinensis</i> | Gray catbird | Thickets and brush, residential areas and gardens |
| <i>Egretta caerulea</i> ¹ | Little blue heron | Freshwater swamps and lagoons in the South; coastal thickets on islands in the North. |
| <i>Egretta thula</i> | Snowy egret | Salt marshes, ponds, rice fields, and shallow coastal bays |
| <i>Egretta tricolor</i> | Tricolored heron | Marshes, ponds, mudflats, swamps, and lagoons |
| <i>Empidonax flaviventris</i> ¹ | Yellow-bellied flycatcher | Thickets of alder and willow in northern coniferous forests; on migration in second-growth woodlands. |
| <i>Empidonax traillii</i> ² | Willow flycatcher | Swampy thickets, upland pastures, and old abandoned orchards |
| <i>Empidonax virescens</i> | Acadian flycatcher | Beech-maple or hemlock forest, usually under the canopy but also in clearings; often in wooded ravines |
| <i>Eremopila alpestris</i> | Horned lark | Plains, fields, airports, and beaches |
| <i>Eudocimus albus</i> | White ibis | Marshy sloughs, mud flats, lagoons, and swamp forests |
| <i>Euphagus carolinus</i> | Rusty blackbird | Wooded swamps and damp woods with pools during migration; boreal bogs in the breeding season |
| <i>Falco columbarius</i> | Merlin | Coniferous forests; more widespread in winter |
| <i>Falco peregrinus</i> ¹ | Peregrine falcon | Open country, especially along rivers, also near lakes, and the coast. Migrates chiefly along the coast. |
| <i>Falco sparverius sparverius</i> | American kestrel | Towns and cities, parks, farmlands, and open country |
| <i>Fulica americana</i> | American coot | Open ponds and marshes; in winter, also in saltwater bays and inlets |
| <i>Gallinula chloropus</i> | Common moorhen | Freshwater marshes and ponds with cattails and other aquatic vegetation |
| <i>Gallinago gallinago</i> | Common snipe | Freshwater marshes, ponds, flooded meadows, and fields; more rarely in salt marshes |
| <i>Gavia immer</i> | Common loon | Forested lakes and rivers; oceans and bays in winter |

Table 3-23: Potential Avifaunal Inhabitants of Jamestown Project Area

| Scientific Name | Common Name | Preferred Habitat |
|---|-------------------------|---|
| <i>Gavia stellata</i> ² | Red-throated loon | Salt bays and tundra ponds during the summer; bays and estuaries and ocean in winter |
| <i>Geothlypis trichas brachidactylus</i> | Common yellowthroat | Moist thickets and grassy marshes |
| <i>Guiraca caerulea caerulea</i> | Blue grosbeak | Brushy, moist pastures and roadside thickets |
| <i>Haliaeetus leucocephalus</i> | Bald eagle | Tall pines and open woods adjacent to open water. |
| <i>Helminthos vermivorus</i> | Worm-eating warbler | Dry wooded hillsides |
| <i>Hirundo rustica</i> | Barn swallow | Agricultural land, suburban areas, marshes, lake shores |
| <i>Hylocichla mustelina</i> | Wood thrush | Moist deciduous woodlands with a thick understory; also well-planted parks and gardens |
| <i>Icteria virens virens</i> | Yellow-breasted chat | Dense thickets and brush, often with thorns; streamside tangles and dry hillsides |
| <i>Icterus galbula</i> | Baltimore oriole | Deciduous woodland and shade trees. American elm was traditionally a preferred nesting site before their decline |
| <i>Icterus spurius</i> | Orchard oriole | Orchard, shade trees in parks and gardens, and scattered trees along lakes and streams |
| <i>Ixobrychus exilis exilis</i> | Least bittern | Freshwater marshes where cattails and reeds predominate |
| <i>Junco hyemalis</i> | Dark-eyed junco | Coniferous or mixed forests; winters in fields, gardens, city parks, and roadside thickets |
| <i>Larus argentatus</i> | Herring gull | Lakes, rivers, estuaries, and beaches; common in all aquatic habitats |
| <i>Larus atricilla</i> | Laughing gull | Salt marshes, bays, and estuaries; very rare inland |
| <i>Larus delawarensis</i> | Ring-billed gull | Lakes and rivers; many move to salt water in the winter |
| <i>Larus fuscus</i> | Lesser black-back gull | Nearly all types of open country—coasts, islands, fields, lakes, airports, refuse dumps, etc. |
| <i>Larus marinus</i> | Great black-backed gull | Coastal beaches, estuaries, and lagoons; also at refuse dumps. Less commonly on inland lakes and rivers |
| <i>Larus philadelphia</i> | Bonaparte's gull | Forested lakes and rivers; winters along the coast, in estuaries, and at the mouth of large rivers |
| <i>Laterallus jamaicensis</i> | Black rail | Coastal salt marshes, rarely inland in freshwater marshes |
| <i>Limnodromus griseus</i> | Short-billed dowitcher | Mud flats, creeks, salt marshes, and tidal estuaries |
| <i>Limnothlypis swainsonii</i> ¹ | Swainson's warbler | Wooded swamps and southern canebrakes; also rhododendron thickets in the mountains. |
| <i>Lophodytes cucullatus</i> | Hooded merganser | Wooded ponds, lakes, and rivers; sometimes in tidal channels in winter |
| <i>Loxia curvirostra</i> ¹ | Red crossbill | Coniferous forests; visits ornamental evergreens in winter. |
| <i>Loxia leucoptera</i> | White-winged crossbill | Coniferous forests; more widespread in winter |
| <i>Melanerpes carolinus</i> | Red-bellied woodpecker | Open and swamp woodland; comes into parks during migration and to feeders in winter |
| <i>Melanerpes erythrocephalus</i> | Red-headed woodpecker | Open country, farms, rural roads, open park-like woodland, and golf courses |
| <i>Meleagris gallopavo</i> | Wild turkey | Open woodlands and forests with scattered natural or man-made clearings |
| <i>Melospiza georgiana</i> | Swamp sparrow | Freshwater marshes and open wooded swamps; in migration with other sparrows in weedy fields, parks, and brush piles |
| <i>Melospiza lincolni</i> ¹ | Lincoln's sparrow | Brushy bogs, willow, or alder thickets; winter in woodlad thickets and brushy pastures. |
| <i>Melospiza melodia</i> | Song sparrow | Thickets, pastures, undergrowth in gardens, and city parks |
| <i>Mergus merganser americanus</i> | Common merganser | Wooded rivers and ponds; in winter, also on salt bays |
| <i>Mergus serrator serrator</i> | Red-breasted merganser | Northern lakes and tundra ponds; in winter, principally on the ocean and in salt bays |

Table 3-23: Potential Avifaunal Inhabitants of Jamestown Project Area

| Scientific Name | Common Name | Preferred Habitat |
|---|----------------------------|--|
| <i>Mimus polyglottos</i> | Northern mockingbird | Residential areas, city parks, farmlands, open country with thickets, and desert brushland |
| <i>Mniotilta varia</i> | Black-and-white warbler | Primary and secondary forest, chiefly deciduous. In migration in parks, gardens, and lawn areas with trees and shrubs |
| <i>Molothrus ater</i> | Brown-headed cowbird | Agricultural land, fields, woodland edges, and suburban areas |
| <i>Myiarchus crinitus</i> | Great-crested flycatcher | Open forest, orchards, and large trees in farm country |
| <i>Nyctanassa violacea</i> | Yellow-crowned night heron | Wooded swamps and coastal thickets |
| <i>Nycticorax nycticorax hoactii</i> | Black-crowned night heron | Marshes, swamps, and wooded streams |
| <i>Oporornis agilis</i> | Connecticut warbler | Open larch-spruce bogs; in migration in low wet woods and damp thickets |
| <i>Oporornis formosus</i> | Kentucky warbler | Low, moist, rich woodland with luxuriant undergrowth; often in ravines |
| <i>Oporornis philadelphia</i> ¹ | Mourning warbler | Dense thickets of blackberries and briars in forest clearings; also in wet woods with thick undergrowth. |
| <i>Otus asio</i> | Eastern screech owl | Open deciduous woods, wood lots, suburban areas, lakeshores, old orchards |
| <i>Oxyura jamaicensis</i> | Ruddy duck | Freshwater marshes, marshy lakes and ponds; sometimes shallow salt bays and rivers in winter |
| <i>Pandion haliaetus carolinensis</i> | Osprey | Lakes, rivers, and sea coasts |
| <i>Parula americana</i> | Northern parula | Breeds in wet, chiefly coniferous woods, swamps, and along lakes and ponds; more widespread on migration |
| <i>Passer domesticus</i> | House sparrow | Cities, towns, agricultural areas |
| <i>Passerculus sandwichensis</i> | Savannah sparrow | Fields, prairies, salt marshes, and grassy dunes |
| <i>Passerella iliaca</i> | Fox sparrow | Coniferous forest undergrowth in summer; dense woodland thickets, weedy pastures, and brushy roadsides in winter |
| <i>Passerina cyanea</i> | Indigo bunting | Brushy slopes, abandoned farmland, old pastures and fields grown up to scrub, woodland clearings, and forest edge adjacent to fields |
| <i>Pelecanus erythrorhynchos</i> | American white pelican | Marshy lakes and along the Pacific and Texas coasts. Winters chiefly in coastal lagoons |
| <i>Phalacrocorax auritus</i> | Double-crested cormorant | Lakes, rivers, swamps, and coasts |
| <i>Phalacrocorax carbo</i> | Great cormorant | Cliffs, rocks, and trees of coastal inlands |
| <i>Phalaropus tricolor</i> | Wilson's phalarope | Prairie pools and marshes, lake and pond shorelines, marshy areas along the coast |
| <i>Phasianus colchicus</i> | Ring-necked pheasant | Farmlands, pastures, and grassy woodland edges |
| <i>Pheucticus ludovicianus</i> ¹ | Rose-breasted grosbeak | Moist woodland adjacent to open fields with tall shrubs; also old and overgrown orchards. |
| <i>Phoenicopus ruber</i> | Greater flamingo | Shallow coastal lagoons and mudflats |
| <i>Picoides pubescens medianus</i> | Downy woodpecker | Wood lots, parks, and gardens; suet feeders in winter |
| <i>Picoides villosus</i> | Hairy woodpecker | Deciduous forest; more widespread in winter and migration |
| <i>Pipilo erythrophthalmus</i> | Eastern towhee | Thickets, and brushy woodland edges |
| <i>Piranga olivacea</i> | Scarlet tanager | Chiefly mature woodland, especially oak and pine |
| <i>Piranga rubra</i> | Summer tanager | Open woodland and shade trees |
| <i>Plectrophenax nivalis nivalis</i> | Snow bunting | Arctic tundra Winters on windswept grasslands and beaches |
| <i>Plegadis falcinellus</i> ¹ | Glossy ibis | Marshes, swamps, flooded fields, coastal bays, and estuaries. |

Table 3-23: Potential Avifaunal Inhabitants of Jamestown Project Area

| Scientific Name | Common Name | Preferred Habitat |
|--|-------------------------------|---|
| <i>Podilymbus podiceps</i> | Pied-billed grebe | Marshes, ponds; salt water in winter if freshwater habitats freeze |
| <i>Podiceps auritus</i> | Horned grebe | Marshes and lakes in summer; in winter, mainly on salt water but also on the great lakes |
| <i>Poecile carolinensis</i> | Carolina chickadee | Deciduous woodlands and residential area |
| <i>Poliophtila caerulea</i> | Blue-gray gnatcatcher | Open, moist woodlands and brushy streamside thickets |
| <i>Poocetes gramineus</i> | Vesper sparrow | Fields, pastures, and roadsides in farming country |
| <i>Porzana carolina</i> | Sora | Chiefly freshwater marshes and marshy ponds; rice fields and salt marshes in winter |
| <i>Progne subis</i> | Purple martin | Open woodland , residential areas, and agricultural land |
| <i>Protonotaria citrea</i> | Prothonotary warbler | Wooded swamps, flooded bottomland forest, and streams with dead trees |
| <i>Quiscalus quiscula</i> | Common grackle | Lawns, parks, fields, open woodland |
| <i>Rallus elegans</i> | King rail | Freshwater marshes and roadside ditches; wanders to salt marshes in fall and winter |
| <i>Rallus limicola</i> | Virginia rail | Freshwater and brackish marshes. May visit salt marshes in winter |
| <i>Rallus longirostris crepitans</i> | Clapper rail | Salt marshes, bays, and estuaries; very rare inland |
| <i>Regulus calendula</i> | Ruby-crowned kinglet | Coniferous forests in summer; also deciduous forests and thickets in winter |
| <i>Regulus satrapa</i> ¹ | Golden-crowned kinglet | Dense, old conifer stands; also in deciduous forests and thickets in winter. |
| <i>Riparia riparia</i> ¹ | Bank swallow | Rivers and streams, especially near sandbanks; more widespread during migration. |
| <i>Rychops niger</i> ¹ | Black skimmer | Breeds chiefly on sandbars and beaches; feeds in shallow bays, inlets, and estuaries. |
| <i>Sayornis phoebe</i> | Eastern phoebe | Open woodland near streams; cliffs, bridges, and buildings with ledges |
| <i>Scolopax minor</i> | American woodcock | Moist woodland and thickets near open fields |
| <i>Seiurus aurocapillus</i> | Ovenbird | Mature dry forest with little undergrowth |
| <i>Seiurus motacilla</i> | Louisiana waterthrush | Prefers swift moving brooks on hillsides and, where the northern waterthrush is absent, occurs in river swamps and along sluggish streams |
| <i>Seiurus noveboracensis</i> ¹ | Northern waterthrush | Cool bogs, wooded swamps, and lake shores in the breeding season; almost any wooded habitat in migration. |
| <i>Setophaga ruticilla</i> | American redstart | Second-growth woodlands; thickets with saplings |
| <i>Sialia sialis</i> | Eastern bluebird | Open farmlands with scattered fields |
| <i>Sitta canadensis</i> ¹ | Red-breasted nuthatch | Coniferous forests; more widespread in migration and winter. |
| <i>Sitta carolinensis</i> | White-breasted nuthatch | Deciduous and mixed forest |
| <i>Sitta pusilla</i> | Brown-headed nuthatch | Coniferous and mixed forests |
| <i>Sphyrapicus varius</i> | Yellow-bellied sapsucker | Young, open deciduous or mixed forest with clearings; in migration, in parks, yards, gardens |
| <i>Spiza americana</i> | Dickcissel | Open grain and hay fields |
| <i>Spizella arborea</i> | American tree sparrow | Arctic willow and birch thickets, fields, weedy woodland edges, and roadside thickets in winter |
| <i>Spizella passerina</i> | Chipping sparrow | Grassy woodland edges, gardens, city parks, brushy pastures, and lawns |
| <i>Spizella pusilla</i> | Field sparrow | Abandoned fields and pastures grown up to weeds, scattered bushes, and small saplings |
| <i>Stelgidopteryx serripennis</i> | Northern rough-winged swallow | Streams and rivers, especially in the vicinity of steep banks and man-made structures providing nest sites |
| <i>Sterna albfrons</i> | Least tern | Sandy and pebbly beaches along the coast; sandbars in large rivers. Often on land fills. |
| <i>Sterna caspia</i> ¹ | Caspian tern | Sandy or pebbly shores of lakes and large rivers, and along seacoasts. |
| <i>Sterna forsteri</i> ¹ | Forster's tern | Salt marshes in the East; freshwater marshes in the West. |

Table 3-23: Potential Avifaunal Inhabitants of Jamestown Project Area

| Scientific Name | Common Name | Preferred Habitat |
|---|------------------------|---|
| <i>Sterna hirundo</i> | Common tern | Lakes, ponds, rivers, coastal beaches, and islands |
| <i>Sterna maxima maximus</i> | Royal tern | Sandy beaches |
| <i>Strix varia</i> | Barred owl | Low, wet woods and swamp forest |
| <i>Stumella magna</i> | Eastern meadowlark | Meadows, pastures, and prairies; in migration, in open country generally |
| <i>Stumus vulgaris</i> | European starling | Cities, suburban areas, farmlands, and ranches |
| <i>Tachycineta bicolor</i> | Tree swallow | Lake shores, flooded meadows, marshes, and streams |
| <i>Thryothorus ludovicianus</i> | Carolina wren | Woodland thickets, ravines, and rocky slopes covered with brush |
| <i>Toxostoma rutum</i> | Brown thrasher | Thickets, fields with scrub, and woodland borders |
| <i>Tringa flavipes</i> | Lesser yellowlegs | Marshy ponds, lake and river shores, mud flats; in the breeding season, boreal bogs |
| <i>Tringa melanoleuca</i> | Greater yellowlegs | Prefers pools, lakeshores, and tidal mud flats on migration, but open wet tundra and marshy ground in the breeding season |
| <i>Tringa solitaria</i> ¹ | Solitary sandpiper | Inland ponds and bogs, wet swampy places, and woodland streams. |
| <i>Troglodytes aedon</i> | House wren | Residential areas, city parks, farmlands, and woodland edges |
| <i>Troglodytes troglodytes</i> ¹ | Winter wren | Dense tangles and thickets in coniferous and mixed forests. |
| <i>Turdus migratorius</i> | American robin | Towns, gardens, open woodland, and agricultural land |
| <i>Tyrannus tyrannus</i> | Eastern kingbird | Open country; farms, orchards, roadsides, and lake and river shores |
| <i>Tyto alba</i> ¹ | Barn owl | Open country, forest edge and clearings, cultivated areas, and cities. |
| <i>Vermivora celata</i> | Orange-crowned warbler | Thickets and brushy woodlands |
| <i>Vermivora peregrina</i> ¹ | Tennessee warbler | Open mixed woodlands in the breeding season; in trees and bushes during migration. |
| <i>Vermivora pinus</i> | Blue-winged warbler | Abandoned fields and pastures grown up to saplings; forest clearings and edges with clumps of catbrier, blackberry, and various bushes and young trees. |
| <i>Vermivora ruficapilla</i> ¹ | Nashville warbler | Woodland edges; thickets in open mixed forest or brushy borders of swamps. |
| <i>Vireo flavifrons</i> | Yellow-throated vireo | Tall deciduous trees at the edge of forests, along streams, roadsides, orchards, parks, and estates |
| <i>Vireo gilvus gilvus</i> ² | Warbling vireo | Deciduous woodland, especially near streams; in isolated groves and shade trees |
| <i>Vireo griseus</i> | White-eyed vireo | Dense swampy thickets and hillsides with blackberry and briar tangles |
| <i>Vireo olivaceus</i> | Red-eyed vireo | Deciduous forest, and shade trees in residential areas |
| <i>Vireo solitarius</i> | Blue-headed vireo | Coniferous and mixed forests |
| <i>Wilsonia canadensis</i> ¹ | Canada warbler | Cool, moist woodland that is nearly mature and has much undergrowth. |
| <i>Wilsonia citrina</i> | Hooded warbler | Mature, moist forest with luxuriant undergrowth, especially in ravines; also in wooded swamps |
| <i>Wilsonia pusilla</i> ¹ | Wilson's warbler | Moist thickets in woodland and along streams; alder and willow thickets and bogs. |
| <i>Zenaidura macroura carolinensis</i> | Mourning dove | Open fields, parks, and lawns with many trees and shrubs |
| <i>Zonotrichia albicollis</i> | White-throated sparrow | Brushy undergrowth in coniferous woodland. Winters in brush woodland, pastures, and suburban areas |
| <i>Zonotrichia leucophrys</i> | White-crowned sparrow | Nests in dense brush, especially where near open grassland; winters in open woods and gardens |

Notes: 1 - Species referenced only by Dr. Bryan Watts.
2 - Species referenced only by Virginia Department of Game and Inland Fisheries.

Fisheries

The study area's location offers multiple habitat types for fisheries resources. This unique quality results from its position near the upper reaches of tidal waters associated with the mouth of the James River and Chesapeake Bay. At Jamestown Island, freshwaters from the upper James River and Powhatan Creek begin to meet tidal saline waters to create several distinct ecological variants. As a result, this region supplies habitat for anadromous, estuarine, and freshwater species important to commercial and recreational fisheries industries.

The Virginia Department of Game and Inland Fisheries (1999) and the U.S. Fish and Wildlife Service (Swihart et al. 1991) have performed surveys in the vicinity of Jamestown Island to monitor fluctuations in fisheries populations. Sampling was conducted in Sandy Bay, Back River, The Thorofare, Kingsmill Creek, and several small creeks throughout the Island (Swihart et al. 1991), and in the James River near Swann's Point (Odum and Swihart 1998). The combined results of these studies yielded a total of 53 species collected in the James River, Powhatan Creek, and Back River (Table 3-24). The composition of sampled species varied between the spring and fall sampling periods because of seasonal fluctuations in salinity levels. Populations of fish preferring freshwater were highest during the spring, when seasonally high rainfall routinely increases freshwater flow from upstream rivers, lowering the salinity in the region. Conversely, seasonal periods of lower rainfall have been shown to result in salinity levels rising to create oligohaline conditions preferable to perch, striped bass, and mullet.

Anadromous Fish

Anadromous species spend their adult lives in marine or brackish waters and travel to fresher waters in inland drainages and rivers to spawn. Five species worthy of mentioning within this category include shad, herring, striped bass, white perch, and Atlantic sturgeon.

Shad. Shad has historically been an important commercial fish, reaching its peak in the late 1800s. Population declines over the years have been attributed to multiple issues such as damming of rivers, pollution, sedimentation, and overharvesting (Klauda et al. 1991a) to such an extent that a moratorium on recreational fishing has been in place since the 1980s. VDGIF has begun a restoration program for the American shad in hopes of reversing this decline, which, according to agency officials, has been successful. Furthermore, recent studies conducted by the Virginia Institute of Marine Science are showing increases in gizzard and threadfin shad populations (Onley 2001).

Herring. Herring has also been an important commercial fish. However, as with the shad populations, the herring populations have seen a decline since the 1970s, even more dramatically than all the other anadromous fish (Klauda et al. 1991b). The decline began as a result of several causes, which include overharvesting, the decline in stock abundance, and the gradual loss of upstream spawning habitat. Alewife and blueback herring, two species sampled in the Jamestown Island area, are viewed similarly as "river herring" in the commercial fisheries industry (U.S. Department of Transportation 1994). These fish occur in all Atlantic coast states except Georgia (Klauda et al. 1991a).

Striped Bass. Striped bass are semi-anadromous fish in that they migrate to tidal freshwater areas just above the salt wedge to spawn (U.S. Department of Transportation 1994). As the Chesapeake Bay region is considered the most primary spawning area, they are considered one of the most highly sought-after commercial and recreational fish in Virginia. Population levels have fluctuated over the years, even to the extent that fishing was closed to striped bass during the 1980s. However, fishing has been reopened with size restrictions and creel limits.

Table 3-24: Fish Species Collected in James River, Powhatan Creek, and Back River (Swihart et al. 1991, Virginia Game and Inland Fisheries, 1999).

| Scientific Name | Common Name | Lifestyle | Scientific Name | Common Name | Lifestyle |
|---|------------------------|-------------------|--------------------------------|----------------------|-------------------------|
| <i>Alosa aestivalis</i> | Blueback herring | Semi-anadromous | <i>Leiostomus xanthurus</i> | Spot | Marine |
| <i>Alosa pseudoharengus</i> | Alewife | Estuarine | <i>Lepomis auritus</i> | Redbreast sunfish | Freshwater |
| <i>Ameiurus catus</i> | White catfish | Freshwater | <i>Lepomis gibbosus</i> | Pumpkinseed | Freshwater |
| <i>Ameiurus natalis</i> | Yellow bullhead | Freshwater | <i>Lepomis gulosus</i> | Warmouth | Freshwater |
| <i>Ameiurus nebulosus</i> | Brown bullhead | Freshwater | <i>Lepomis macrochirus</i> | Bluegill | Freshwater |
| <i>Amia calva</i> | Bowfin | Freshwater | <i>Lepomis microlophus</i> | Redear sunfish | Freshwater |
| <i>Anguilla rostrata</i> | American eel | Catadromous | <i>Membras martinica</i> | Rough silverside | Marine |
| <i>Aphredoderus sayanus</i> | Pirate perch | Freshwater | <i>Menidia beryllina</i> | Inland silverside | Estuarine |
| <i>Brevoortia tyrannus</i> | Atlantic menhaden | Marine, estuarine | <i>Menidia menidia</i> | Atlantic silverside | Estuarine |
| <i>Clinostomus funduloides</i> | Royside Dace | Freshwater | <i>Menidia peninsulae</i> | Tidewater silverside | Estuarine |
| <i>Cyprinella analostana</i> | Satinfin shiner | Freshwater | <i>Micropogonias salmoides</i> | Largemouth bass | Freshwater |
| <i>Cyprinus carpio carpio</i> | Common carp | Freshwater | <i>Micropogonias undulatus</i> | Atlantic croaker | Marine |
| <i>Dorosoma cepedianum</i> | Gizzard shad | Anadromous | <i>Morone americana</i> | White perch | Semi-anadromous |
| <i>Dorosoma petenense</i> | Threadfin shad | Anadromous | <i>Morone saxatilis</i> | Striped bass | Semi-anadromous |
| <i>Engraulis mordax</i> | Bay anchovy | Estuarine | <i>Mugil cephalus</i> | Striped mullet | Estuarine |
| <i>Enneacanthus gloriosus</i> | Bluespotted sunfish | Freshwater | <i>Mugil curema</i> | White mullet | Estuarine |
| <i>Erimyzon oblongus</i> | Creek chubsucker | Freshwater | <i>Notemigonus crysoleucas</i> | Golden shiner | Freshwater |
| <i>Esox niger</i> | Chain pickerel | Freshwater | <i>Notropis hudsonius</i> | Spottail shiner | Freshwater |
| <i>Etheostoma olmstedii</i> | Tessellated darter | Freshwater | <i>Noturus gyrinus</i> | Tadpole madtom | Freshwater |
| <i>Fundulus diaphanus diaphanus</i> | Banded killifish | Freshwater | <i>Noturus insignis</i> | Margined madtom | Freshwater |
| <i>Fundulus heteroclitus heteroclitus</i> | Mummichog | Estuarine | <i>Paralichthys dentatus</i> | Summer flounder | Estuarine |
| <i>Gambusia holbrooki</i> | Eastern mosquitofish | Freshwater | <i>Perca flavescens</i> | Yellow perch | Freshwater |
| <i>Gobiosoma boscii</i> | Naked goby | Estuarine | <i>Pomoxis nigromaculatus</i> | Black crappie | Freshwater |
| <i>Hybognathus regius</i> | Eastern silvery minnow | Freshwater | <i>Syngnathus sp.</i> | Pipefish | Estuarine |
| <i>Ictalurus furcatus</i> | Blue catfish | Freshwater | <i>Trinectes maculatus</i> | Hog choker | Estuarine to freshwater |
| <i>Ictalurus punctatus</i> | Channel catfish | Freshwater | <i>Umbra pygmaea</i> | Eastern mudminnow | Freshwater |

Atlantic Sturgeon. The Atlantic sturgeon was once very populous in the Chesapeake region. It is found in the Chesapeake Bay and spawns in the tidal freshwaters of the connecting rivers during April and May. The population has experienced a drastic decline most likely due to overharvesting (Burkhead and Jenkins 1991), but other factors such as pollution, sedimentation, and construction of dams may have also been contributors. The Atlantic sturgeon is not a federally listed species and carries no legal federal status. However, it is a species of special concern, and harvesting of sturgeon is currently prohibited. Most recently, a large, dead Atlantic sturgeon washed up on the shore at Jamestown Island. The specimen was too decomposed to determine sex or actual size (Ha 2001).

Estuarine Fish

Estuarine fish include species that prefer brackish waters. This would include killifish, silversides, the Bay anchovy, and various species of minnows that were sampled near Jamestown Island. While most of these species are not commercially or recreationally important, they are significant in the food web as prey.

Freshwater Fish

During the spring, data seems to support an increase in freshwater fish at Jamestown Island, particularly in Back Bay and Powhatan Creek. The most common of these include largemouth bass, pumpkinseed, channel catfish, bluegill, and sunfish. These species are most notably important to the recreational and sport fisheries industry.

Commercial and Recreational Fisheries

A number of important commercial and recreational fishes were captured in sampling of the James River near Swann's Point (Odum and Swihart 1998). These included American eel, American shad, Atlantic menhaden, blue catfish, channel catfish, white perch, striped bass, bluegill, largemouth bass, black crappie, yellow perch, weakfish, spot, Atlantic croaker, and southern flounder. This diverse mixture of fish is typical of the upper estuarine habitat.

In addition to the fish captured, the commercially and recreationally important blue crab (*Callinectes sapidus*) was encountered at all sites sampled. White shrimp (*Penaeus setiferus*) was also observed and captured in sizeable numbers at several sites.

3.3.2.11 Rare, Threatened, and Endangered Species

According to surveys by the Virginia Department of Conservation and Recreation Division of Natural Heritage, Colonial NHP hosts the second-highest number of rare, threatened, and endangered species of all the NPS units in Virginia (Colonial NHP 1999). Communications with VDNH, the Virginia Department of Game and Inland Fisheries and the U.S. Fish and Wildlife Service, indicate that several federal- and state-listed species, as well as species of special concern, have been documented within and adjacent to the Jamestown Project site (Table 3-25).

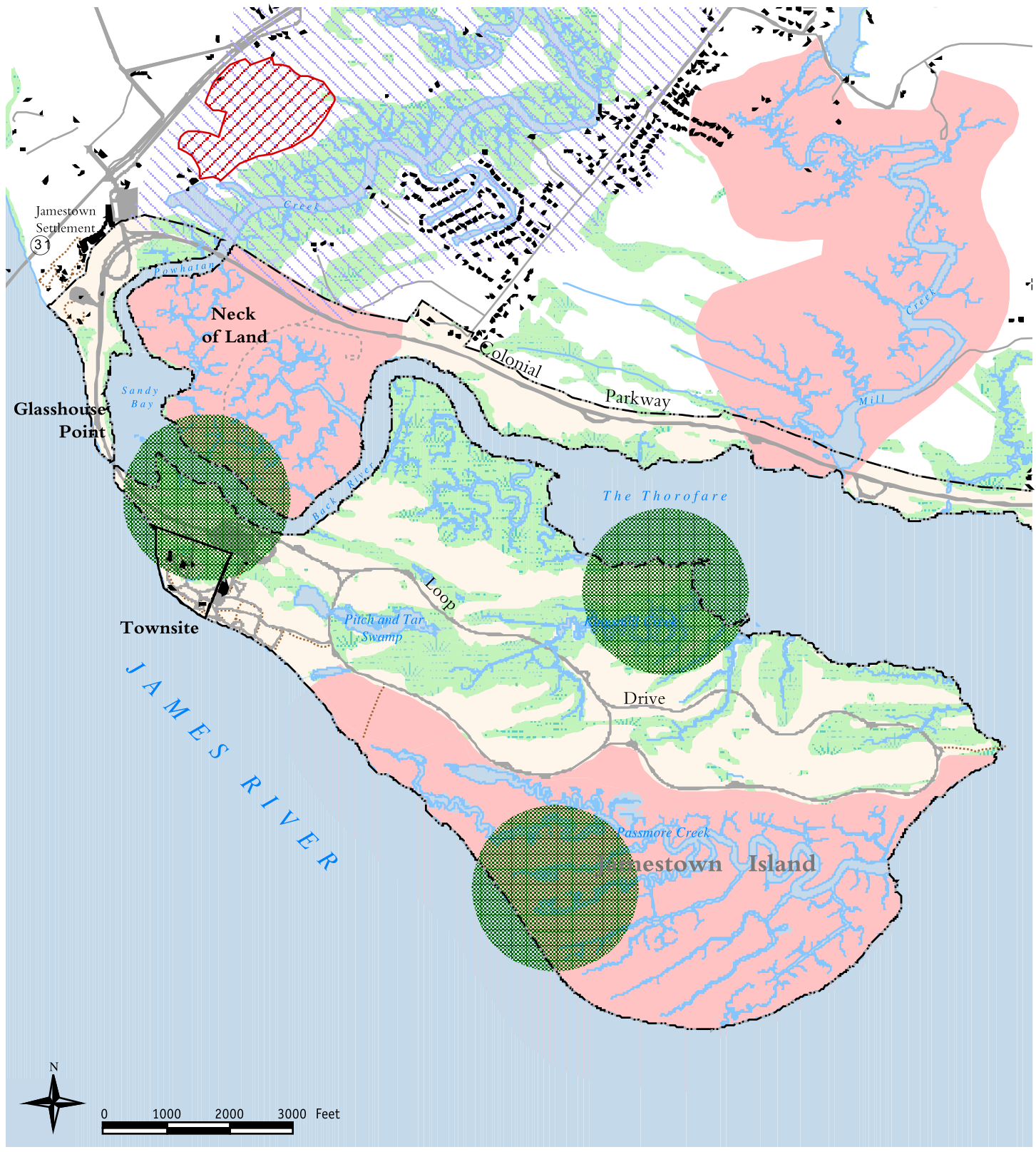
To document the presence of rare, threatened, and/or endangered species, as well as the natural vegetation communities within the Jamestown Project site, VDNH performed surveys for known listed plant and animal species. Observations confirmed the following species: bald eagle, sensitive joint-vetch, gaping panic grass, and the rare skipper (Chazal and Van Alstine 2001). Extensive searches for the small-whorled pogonia failed to locate any existing populations or appropriate habitat within the Jamestown Project site (Chazal 2001). In addition, a search for Parker's pipewort within the mudflats along Back River also found nothing (VDNH 2001b). Figure 3-19 depicts ecologically sensitive areas that may support rare, threatened, or endangered species.

Conservation Sites

Conservation sites, designated by VDNH, represent key areas of the landscape worthy of protection and stewardship action because of the natural heritage resources and habitat they support. Conservation sites are polygons designed around one or more occurrences of rare plant, animal, or natural communities.

Table 3-25: Rare, Threatened, and Endangered Species Potentially Located within or near the Jamestown Project Area

| Scientific Name | Common Name | Status* | Preferred Habitat | Confirmed Occurrences |
|--|-----------------------|----------------------|--|-----------------------|
| <i>Aeschynomene virginica</i> | Sensitive joint vetch | G2/S2/LT/NS | Fresh to slightly brackish tidal marshes | 1 |
| <i>Eriocaulon parkeri</i> | Parker's pipewort | G3/S2/NF/NS | Exposed mudflats | |
| <i>Isotria medeoloides</i> | Small whorled pogonia | G2/S2/LT/LE | Second/third growth hardwood stands on moderate to level slopes with sparse herbaceous plant cover | |
| <i>Steinchisma hians</i> | Gaping panic grass | G5/SH/NF/NS | Marshes, ditches, and seepage slopes | 1 |
| <i>Ardea alba</i> | Great egret | G5/S2B,S3N/NF/SC | Freshwater, salt water marshes, lakes, ponds | 2 |
| <i>Ardea herodias</i> | Great blue heron | G5/S3B,S5N/NF/NS | Lakes, ponds, rivers, marshes | 3 |
| <i>Circus cyaneus</i> | Northern harrier | G5/S1S2B,S3S4N/NF/SC | Marshes, fields, and open grasslands | |
| <i>Haliaeetus leucocephalus</i> | Bald eagle | G4/S2B,S3N/LT,PDL/LE | Tall pines and open woods adjacent to open water | 3 |
| <i>Ixobrychus exilis</i> | Least bittern | G5/S2S3B,S3N/NF/NS | Freshwater marshes, primarily with reeds and cattails | 1 |
| <i>Notropis bifrenatus</i> | Bridle shiner | G5/S2S3/NF/SC | Tidal to slightly brackish waters, marshes, and beaches | |
| <i>Problema bulenta</i> | Rare skipper | G2G3/S1/NF/NS | Slightly brackish river marshes | 1 |
| <i>Sterna antillarum</i> | Least tern | G4/S2B,SZN/NF/SC | Beach dunes, sandbars along rivers | |
| <i>Sterna caspia</i> | Caspian tern | G5/S1B,S2N/NF/SC | Sandy or pebbly shores of lakes, rivers, and sea coasts | |
| <i>Tyto alba pratincola</i> | Barn owl | G5/S3B,S3N/NF/SC | Varied – open woods, forest edges, farms, cities | |
| Notes: *G2/S2/LT/LT: Global Rank / State Rank / Federal Status / State Status; Status information from Townsend 2001 and Roble 2001 | | | | |
| <p>G2: Globally very rare and imperiled G3: Globally very rare and local or locally in a restricted range G4: Globally common and secure G5: Globally abundant</p> <p>S1: In Virginia, extremely rare and critically imperiled S2: In Virginia, very rare and imperiled S3: In Virginia, rare to uncommon S4: In Virginia, apparently secure S5: In Virginia, abundant S_B,S_N: Breeding and non-breeding state ranks, if different</p> <p>SH: Formerly part of Virginia with expectation for recovery SZN: In Virginia, long distance migrant not monitored outside of breeding season or wintering populations are transitory</p> <p>NF: No federal status LT: Federal or state listed threatened LE: Federal or state listed endangered LT,PDL: Federal listed threatened but proposed delisting NS: No state status SC: State species of special concern</p> | | | | |



Legend

| | | | |
|--|---|--|--|
| | Bald Eagle Protection Area (1320' Radius) | | Colonial National Historical Park |
| | Powhatan Creek Watershed | | Association for the Preservation of Virginia Antiquities |
| | VDNH Conservation Zones | | Priority Conservation Area |
| | Wetlands | | |

Figure 3-19: Ecologically Sensitive Areas

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They include the natural heritage resources and, where possible, associated habitat buffer or other adjacent land thought necessary for the resource's conservation. Conservation sites are given a biodiversity significance ranking based on the rarity, quality, and number of natural heritage resources they contain. Two conservation sites are located within or adjacent to the Jamestown project area: Jamestown Island and Mill Creek Marshes (Figure 3-19).

Jamestown Island Conservation Site

The Jamestown Island conservation site contains the former Back River Marshes, Upper Jamestown Island Fields (Chazal and Van Alstine 2000), and Jamestown Island Marshes (Clark and Rafkind 1998), which were merged and extended to create the Jamestown Island conservation site. The site, approximately 2,189 acres, contains tidal communities located north of the Back River at Neck of Land, and on Jamestown Island (including the Back River Marsh, Passmore Creek Marsh, and Pitch and Tar Swamp. In addition to these marshes, the conservation site is approximately half forested, including forested wetlands.

The site has a biodiversity rank of B3 because it supports high biodiversity significance. The Jamestown Island conservation site contains a small population of the federally listed plant sensitive joint-vetch, as well as three nesting sites for the federally threatened bald eagle. The Island also supports a great blue heron rookery. While these birds are not federally listed, they are protected under other federal laws such as the Migratory Bird Treaty Act of 1918 and local regulations that protect colonial waterbirds.

At the western end of the Island, periodically wet areas support a population of at least 120 individuals of the state rare plant gaping panic grass. Watchlist species in this area also included big carpet grass (*Axonopus furcatus*), Florida paspalum (*Paspalum floridanum*), pasture flatsedge (*Kyllinga gracillima*), panic grass (*Panicum anceps*), a

flatsedge (*Cyperus flavicomus*), grass leaved rush (*Juncus biflorus*), forked rush (*Juncus dichotomus*), fall witchgrass (*Panicum dichotomiflorum*), and Virginia buttonweed (*Diodia virginiana*). This site represents the only recently documented occurrence of gaping panic grass in Virginia. Other historical records for gaping panic grass in Virginia are from the late 1930s and early 1940s (Chazal and Van Alstine 2001).

Mill Creek Marsh Conservation Site

Ranked as having high biodiversity significance, the Mill Creek Marsh conservation site contains a small, fringe oligohaline tidal marsh along the north shore of the Thorofare. A population of the rare skipper (*Problema bulenta*), which is globally rare, was discovered in 2001 in the small fringe marsh just west of the mouth of Mill Creek. This is only the second known population of the rare skipper in Virginia (Chazal and Van Alstine 2001).

Sensitive Joint-Vetch

The sensitive joint-vetch (*Aeschynomene virginica*), an annual in the bean family, reaches 3-6 feet in height and bears yellow flowers with red veins. Seed germination occurs between May and early June, while flowering takes place between mid-July and October. The plant produces fruits, legumes 1.2 to 2.8 inches long, which break into one-seeded segments, from late July through late October (Davidson and Bruderle 1985).

The sensitive joint-vetch is known from 26 sites in Maryland, New Jersey, North Carolina, and Virginia. Historically, it has been extended to Delaware and Pennsylvania. Currently, 20 populations are located within Virginia. Population sizes may fluctuate from year to year; however, relative population size tends to remain stable.

The species occurs in fresh to slightly brackish tidal river systems, within the intertidal zone where the populations are flooded twice daily. It typically occurs at the outer fringe of marshes or shores; however, it may be located within marsh interiors because of local nutrient deficiencies, ice scouring,

or muskrat disturbance. Bare to sparsely vegetated substrates are critical to the presence of sensitive joint-vetch; it typically does not compete well with other species.

Sensitive joint-vetch was rediscovered in 2000 at the Jamestown Project site in the Neck of Land marsh (Chazal and VanAlstine 2001). This was only the second sighting of the species at Jamestown Island since its discovery in 1939 (Fernald). Thirteen flowering and fruiting plants were observed on a slightly raised area within the marsh, between an old road trace and slightly denser vegetation. Attempts to locate the vetch in 2001 were unsuccessful.

The FWS listed sensitive joint-vetch as federally threatened in June 1992. The current recovery plan (Schulz 1995) attributes dwindling numbers to both natural and human disturbances. These include: wave action with severe storms, native and invasive species competition (in particular *Phragmites australis*), herbivory, channel migration, sea-level rise, sedimentation, boating activities, shoreline stabilization and structural development, road and bridge construction, and changes in water quality (Schulz 1995).

Bald Eagle

The bald eagle population has made a wonderful comeback in North America since the days of DDT toxicity, particularly in the Chesapeake Bay area. Data obtained from the William and Mary Center of Biological Conservation show that the number of nesting bald eagles in Virginia has increased 906 % since 1977, from 31 to 312 nesting pairs. In 2001, the majority of Virginia's nesting eagles were associated with the Chesapeake Bay and the bay's tributary rivers (Potomac, Rappahannock, York, and James). The success of the eagles' population expansion since the early 1970's has prompted the U.S. Fish and Wildlife Service to change the federal status from endangered to threatened, and a proposal is being reviewed for complete de-listing of the species.

The bald eagle (*Haliaeetus leucocephalus*) in the eastern United States comprises several population cells that tend to migrate and intermingle seasonally throughout the East Coast. A breeding population exists in the northeast United States and Canada that tends to migrate south to the Chesapeake Bay region after the nesting season. At the same time, the breeding population in Florida, the largest of the eastern breeding populations, migrates north during the summer to either the Chesapeake Bay or Great Lakes region or Canada.

In addition, Virginia hosts a population of nonmigratory resident bald eagles that add to the mix. It is during the summer that the largest numbers of eagles congregate in Virginia. The odd migratory and residential behavioral patterns of the eastern eagle populations all point to the Chesapeake Bay region as being one of the most important habitats for the species in eastern North America. The James River, in particular, has been one of the more productive rivers in terms of the number of active nests (71 nests) and fecundity rates (average of 1.62 chicks per active nest compared to a state-wide average of 1.51 chicks per nest).

Eagles have specific habitat requirements based on their desire for fish as their main food source. These consist of nest sites, perching areas, and foraging areas in close proximity to open water (Andrew and Mosher 1982). Preferred nest trees typically consist of tall pines along shorelines that offer open flyways for ease of egress and ingress (McEwan and Hirth 1979). When nest sites are not particularly available along the shoreline, sites have been used several miles away from open water. Some eagles have also shown an ability to habituate to some routine human activities (Stalmaster and Newman 1978). Nest sites have been documented near home sites, boat ramps/marinas, bridges, and golf courses.

Preferred perching habitat consists of tall trees and snags of almost any tree species immediately adjacent to the shoreline of lakes, rivers, bays, and estuaries. Perching areas tend to coincide with

foraging areas of shallow water, such as coves, where the birds can overlook the open water for fish. The same perch sites tend to be frequently used for hunting and for overnight roosting. Perch sites also provide resting sites for migratory birds moving through the Chesapeake Bay region.

As part of the James River habitat corridor, the Jamestown Island project area provides acres of relatively undisturbed, high quality habitat for nesting eagles. The project site currently supports three bald eagle nest sites: one known for a long time and two newly documented. One of the new sites is located on the northwest edge of the Island near the parking area. It appears that the birds using this nest have habituated to automobile traffic in and around the parking lot as well as existing boat traffic in Back River. A brief survey conducted from April to June 2002 showed that eagles had virtually no reaction to passing boats.

The shallow waters of Sandy Bay and nearby James River provide excellent foraging habitat for this pair. Another newly documented nest is located along the northern shoreline of the Island adjacent to The Thorofare. This nest is far removed from human activities that may interfere with nesting behavior. It appears that these birds use The Thorofare and neighboring James River as their main foraging habitat.

The third nest, present for a long time, is located in one of the narrow pine wetlands between the James River shoreline and the Passmore Creek marsh at the southeast end of the Island. These birds have been observed foraging in the shallow water area of the James River near the nest site. The nest site and surrounding area provide relief from human disturbances and offer excellent hunting opportunities.

Standard conservation recommendations for eagle nest sites have been developed by regulatory agencies. These recommendations include the establishment of a primary management zone

extending in a 750-foot radius from the nest site. Within this zone, it is recommended that all passive activities be restricted during the breeding/nesting season (November through July) unless coordinated with the FWS and no habitat modifications occur at any time of the year. In addition, a secondary management zone is recommended to extend from the outer primary zone in a radius of 1,320 feet (0.25 mile) from the nest. Activities in this zone should be reviewed on a case-by-case basis, but significant habitat modifications should be restricted. Minor land clearing may occur if minimized, and visual buffers should be maintained. Work within this zone should also be coordinated with the FWS.

Because of the proximity of the newly identified nest next to the existing parking lot, the APVA and the NPS have been coordinating closely with representatives from the FWS, VDGIF, and VDNH. In April 2001, the FWS issued a biological opinion concerning the current National Park Service operations and the recently discovered bald eagle nest (Appendix F).

3.3.2.12 Visual Quality and Aesthetics

The existing visual environment for the Jamestown Project is defined as what is seen by the visitor during the approach to the project area by land or by water, as well as what is seen by the visitor within the project area itself. The visual environment affects both the anticipation and experience of the project site. The quality of the visual environment is a vital resource for Jamestown and is instrumental in setting the stage for the experience of the Island and its history.

Existing Visual Quality of the Approach to Jamestown

The existing visual environment for the Jamestown Project area is defined in large part by the visual character of the Colonial Parkway (one of two major visitor access routes to Jamestown Island). In the design process for the Parkway, there was deliberate “orchestration of elements into a holistic

landscape composition in distinct context of the James-York peninsula, individual landscape elements of grading, alignment, vegetation, structures, and small scale features all combined to create the complete and unique spatial character and experience of Colonial Parkway.” (Landscapes 1997). The visual experience from the Parkway creates the sense and feelings of remoteness and “wildness” and intimacy with the area’s natural resources by keeping views to any development at a minimum. The visitor is allowed to be visually immersed by marshes, water, forests, wildlife, and long scenic views of the James River. Conditions exist of openness and enclosure and view and vista.

The sense of an island and its setting in the James River is presented to the visitor due to the choreography of the visitor approach, scenic views made visible at various points, buffers to some of the neighboring developments, and the overall sequential design of the Colonial Parkway. “This landscape corridor is composed of the 30-foot-wide (three lane) concrete road bed surrounded by a varying-width strip of mowed lawn, which is either enclosed by forest edge or bordered by a field, marsh, or river view. Despite, or perhaps because of, the relative narrowness of the right of way, the Parkway corridor maintains a distinct identity, one quite separate from surrounding residential suburban developments.” (Landscapes 1997). The visual environment as defined by the Colonial Parkway gives the visitor an important and strong emotional link with Jamestown.

Much of the visual quality of the experience of Jamestown is a result of the beautiful design and layout of the Colonial Parkway, the road design and curves, the sloping shoulders and the buffers to adjacent land use. The visual experience of the natural environment, with expansive and scenic views to marshes, water, wildlife, forests, lawns, the James River, and stands of trees is truly unique and sets the stage for the visitor experience of Jamestown Island. The setting is serene and largely natural with little evidence of adjacent

development. Travel on the Parkway to Jamestown Island gives the visitor a sense of the wildness and remoteness of Jamestown Island. The experience of getting there is as important as the Island destination itself. Therefore, the viewsheds and visual character of the Parkway and adjacent lands as seen from the Parkway are critical to the quality of the visitor experience and are vital resources to be maintained. Other visitors become part of the visual landscape when people stop at overlooks adjacent to the Parkway, walk their dogs along Parkway shoulders, bicycle on the Parkway, travel by boats, watch birds at various areas of the Parkway and on the Island, and generally use the Parkway and Island for recreational purposes.

Due to existing land use designations and the existing land uses bordering the Colonial Parkway (from Colonial Williamsburg to Jamestown), adjacent land owners who are affected by activity on the Parkway are limited to the residential development (off of Neck-O-Land Road, where residential lots border the Parkway buffer) and the Jamestown Marina, distinctly visible from the Parkway and where users of the marina can see back to the Parkway. Jamestown Island is visible from Surry County and from the James River, affecting visitors going across the James on the Jamestown-Scotland Ferry and any independent boat traffic on the James. The Jamestown Explorer, currently running from the Jamestown Marina, accommodates groups of 50 on board and takes advantage of these views of the Island from the James River.

The existing visual environment for the Jamestown Project Area is also defined by the visual quality of Route 31 (Jamestown Road) and State Route 359 through Jamestown Settlement. The visual experience of this access route to the Jamestown Project area is in stark contrast to the visual experience of the Colonial Parkway. On Route 31, the visitor experiences major residential developments on both sides of the road and commercial development as one approaches Route

359. There is no sense of approach to the Island, no way to visually build anticipation for a visit to the original Jamestown site. There is general visual confusion due to the array of signs and continuing commercial and residential development. Once on Route 359, the visitor is confronted with the Jamestown Settlement building, and numerous people trying to cross Route 359 to get into the front door. Potential visitors to the Island see the Settlement buildings, parking, and people before they emerge onto the Colonial Parkway in the vicinity of the Powhatan Creek Overlook. This contrast sets up a very different experience for the visitor to the Jamestown Project area.

Existing Visual Quality of Landscape Units

Viewsheds from the Parkway

There are magnificent scenic views from the Colonial Parkway as it leads to Jamestown Island. In a scenic vista, the Island becomes visible from the Parkway well before the entry booths, which allow visitor access to the Island. Along the Colonial Parkway, specifically from Colonial Williamsburg to Jamestown, the visitor sees little adjacent land development. "Along much of the roadway, forest vegetation screens adjacent development from view, separating the parkway corridor from its neighboring land uses. It gives the motorist a sense of driving through a woodland despite the fact that adjacent development may be within 200 or 300 feet of the roadway" (Landscapes 1997). There is a view to adjacent farmland immediately before the visitor approaches Neck of Land. "Broad views of the river and the inland agricultural landscape are achieved around the lands owned by Gospel Spreading Association where open fields predominate" (Landscapes 1997). Houses along Route 682 in the Page's Landing development visually intrude along the Parkway, especially in the fall and winter after leaf drop. Likewise, Parkway traffic is visible from these residences.

Within the project area, the established viewsheds from the Parkway and within the Jamestown

Project area are graphically displayed on Figures 3-20 through 3-25 and are keyed to the following descriptive text.

Viewshed 1-a

As the visitor travels west on the Parkway, toward Jamestown Island, the first established viewshed to the project area is southeast toward Neck of Land and the edge of Back River. Though the visitor has yet to travel into the project limits, this viewshed offers a glimpse to an important natural feature that is within the Jamestown Project area. The viewshed is located at a break in the trees to the southeast, and the viewshed opens up with a grassy hill and isolated trees in the foreground, the Neck of Land and Back River in the middleground, and the Island itself in the background. The view is clear enough to see cars in the Jamestown Island parking lot. This view can be seen by visitors in cars, walking, or using a bicycle on the Colonial Parkway.

Viewshed 1

As a visitor travels west on the Colonial Parkway, toward Jamestown Island, the first established viewshed within the project limits is north to the NPS maintenance area. Due to large setbacks and screening, the buildings, parking, and general activity of the facility are virtually invisible. There is a sign designating this facility and a driveway, neither of which disrupts the existing visual pattern from the Parkway.

Viewsheds 2 and 3

Immediately after the viewshed to the NPS Maintenance Facility, and as the visitor continues west on the Colonial Parkway, Neck of Land becomes visible to the south. Neck of Land, with its forest vegetation, encloses the viewshed and prohibits any long scenic vistas toward Jamestown Island. Though the area is heavily wooded, there is a grass lawn/buffer approximately 100 feet wide from the tree line to the Parkway. This width varies along the length of Neck of Land as it borders the Parkway, although there are no vistas

into Neck of Land from the Parkway. Hiking onto Neck of Land by the Old Route 31 road trace reveals some scenic views to the Island once the hiker has passed through the forest vegetation, tall grasses, and marsh.

Viewsheds 4 and 5

From the Powhatan Creek bridge on the Colonial Parkway there are two established viewsheds, one to the north and one to the south. Viewshed 4, to the north, includes the Jamestown Marina. The marina is distinctly visible as the visitor heading west approaches Jamestown Island. This dilapidated/disheveled appearance of the marina and the bright color of boat covers are a stark contrast to the scenic views and natural character that dominate the views of the project area from the Parkway. The Viewshed 5, to the south, includes a long scenic vista that contains Jamestown Island, Sandy Bay bridge, and on a clear day, the banks of Surry County across the James River. Also within this viewshed is the Powhatan Creek Overlook and its shoreline erosion.

Viewsheds 6 and 7

As the visitor travels west on the Parkway toward Jamestown Island, there are views into Jamestown Settlement. These views begin where the Parkway divides, going right to Jamestown Settlement and left to the Jamestown Island entry booths. Settlement traffic on Route 359 in front of the existing building is also visible from the Parkway.

Viewshed 8

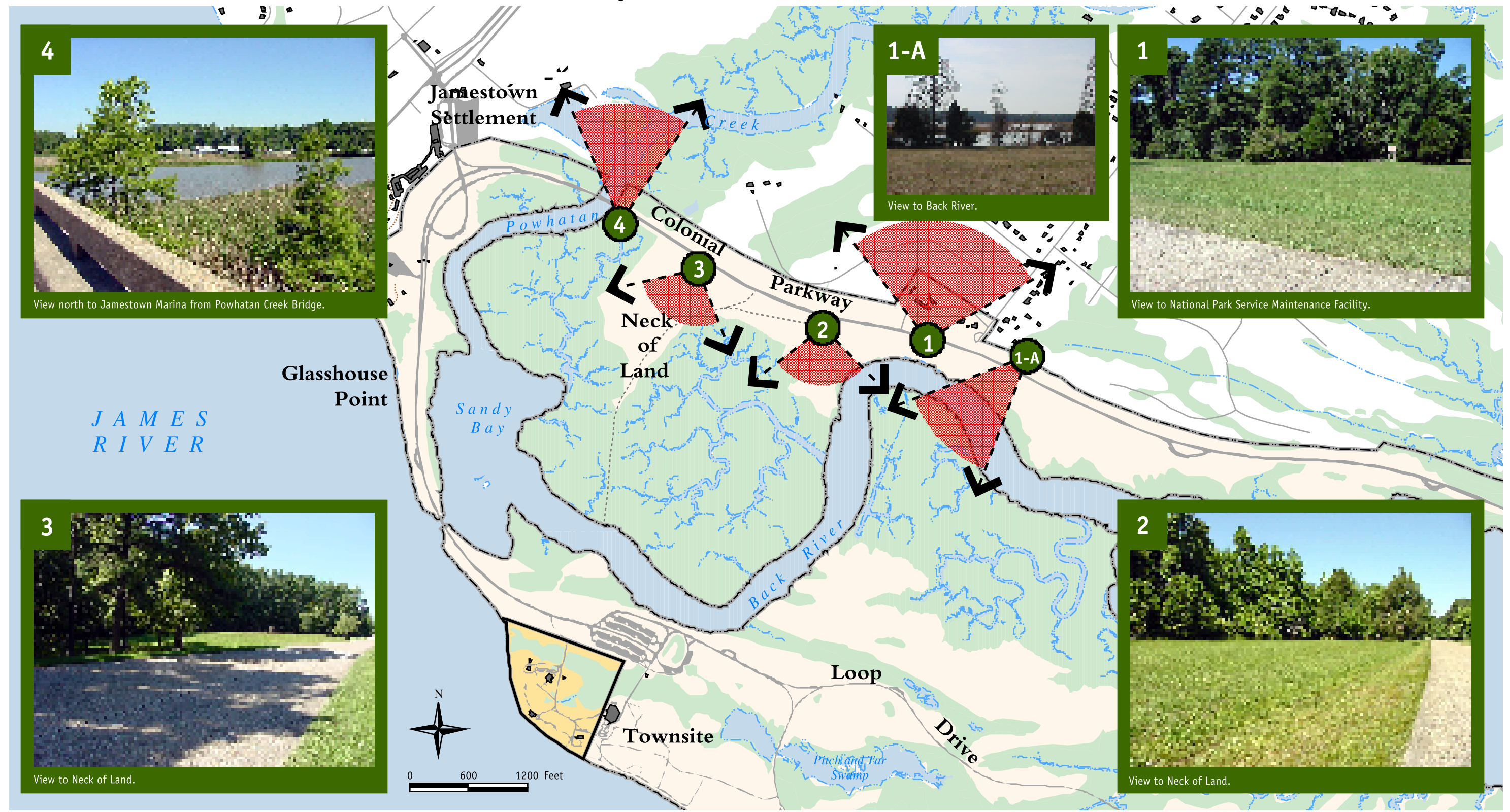
The viewshed from the Powhatan Creek Overlook includes the Powhatan Creek bridge and traffic on the bridge. The entire Powhatan Creek waterway is visible, including all the existing boat traffic. The isthmus is also visible from the overlook, as is the traffic on the isthmus. Jamestown Island is visible from the overlook, in a long scenic vista with no visual interruptions.

Viewsheds 9, 10, and 11

From the Jamestown Settlement entrance to the Jamestown Island entry booths, the views are narrow and enclosed. As the visitor travels south toward Jamestown Island, the views open up again, and the viewshed includes long scenic vistas toward Neck of Land and back to the Powhatan Creek bridge (Viewshed 9), views of the Jamestown-Scotland Ferry landing and the “three ships” belonging to the Settlement (Viewshed 10), and views across the James River to Surry County (Viewshed 11). Surry County has some vacation home zoning on the waterfront, and portions of that subsequent development are in this viewshed. There is also bank erosion in this viewshed to Surry County.

Viewsheds 12 and 13

From the isthmus, views to the east include a panorama of Neck of Land and the northern tip of Jamestown Island (Viewshed 12). This viewshed also includes a long vista down Back River with all the existing private boat traffic and the Jamestown Explorer. Within this viewshed are the old telephone poles along the road trace on Neck of Land. The road trace (pre-1957), with existing asphalt, runs through Neck of Land to the water of Back River. The asphalt itself is not visible from the Parkway. Tall grasses (8 to 10 feet) grow on either side of the road trace. Viewshed 13 provides a continuous view to the west of Surry County. The Jamestown-Scotland Ferry is constantly visible from this portion of the Parkway, as are barge traffic, the Jamestown Explorer, and numerous fishing and recreational boats on the James River.



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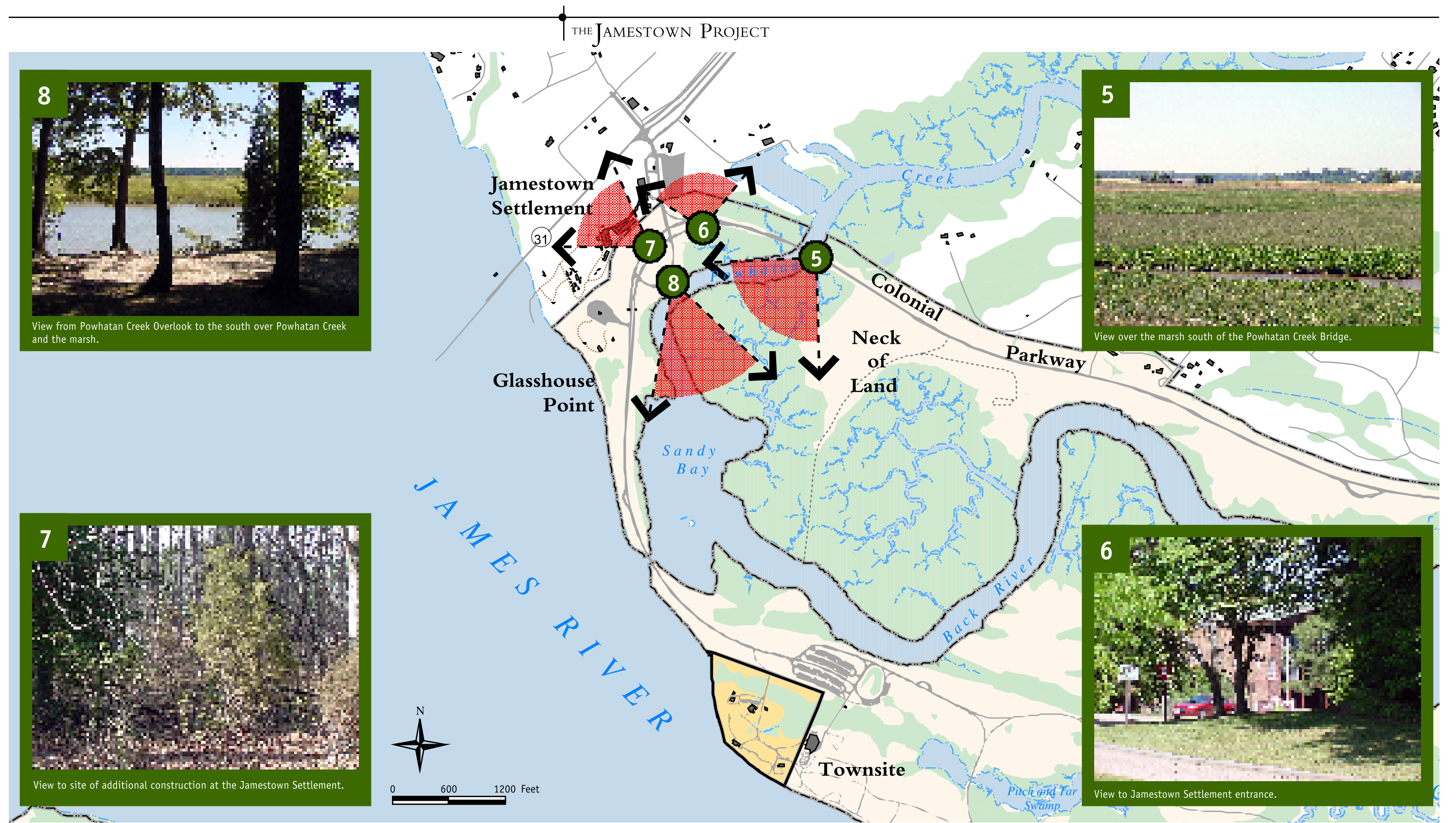
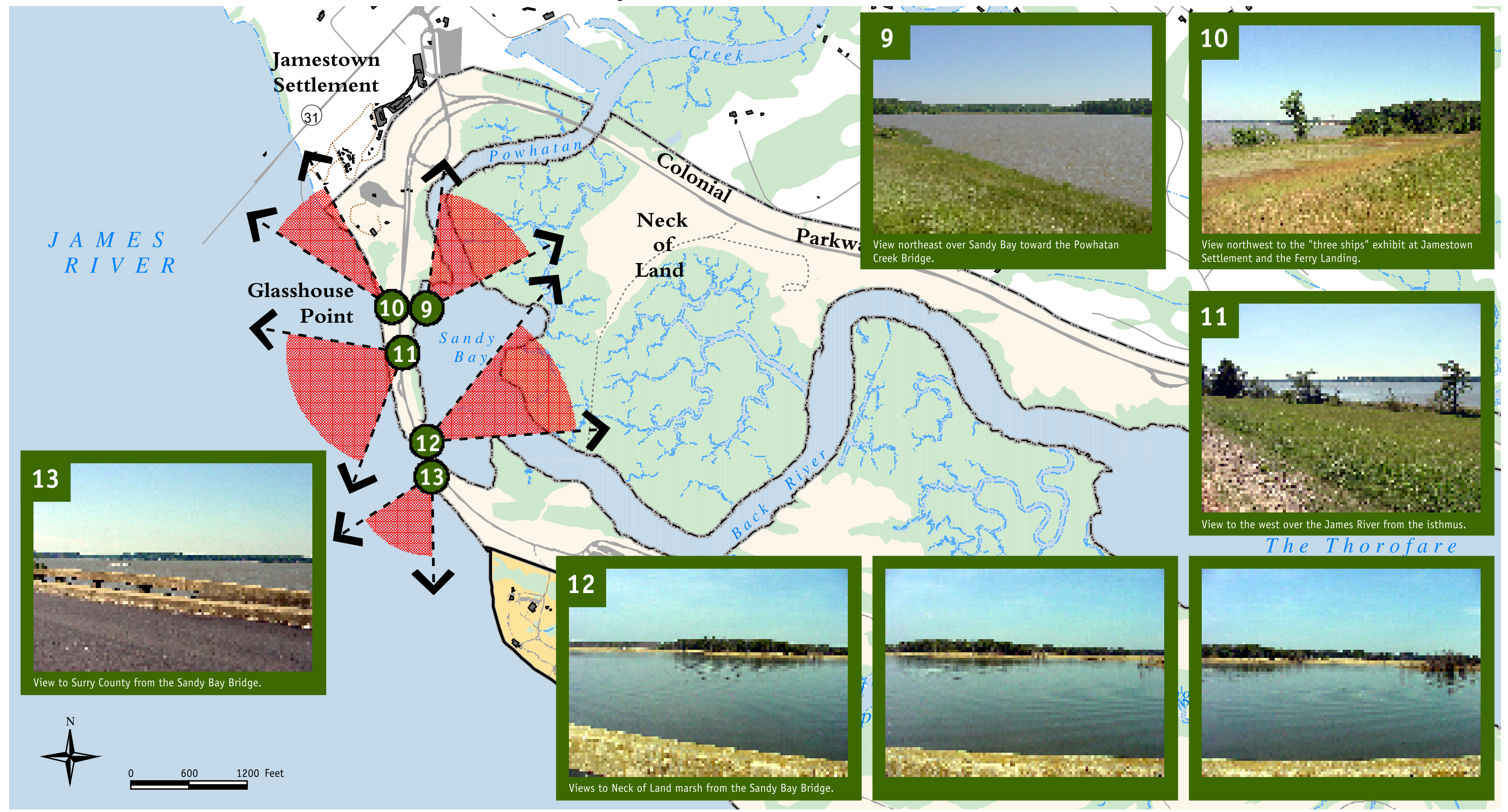


Figure 3-21: Established Views 5-8

Views are from the Colonial Parkway.

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Legend

- Wetlands
- Colonial National Historical Park
- Association for the Preservation of Virginia Antiquities

Figure 3-22: Established Viewsheds 9-13

Views are from the Colonial Parkway.

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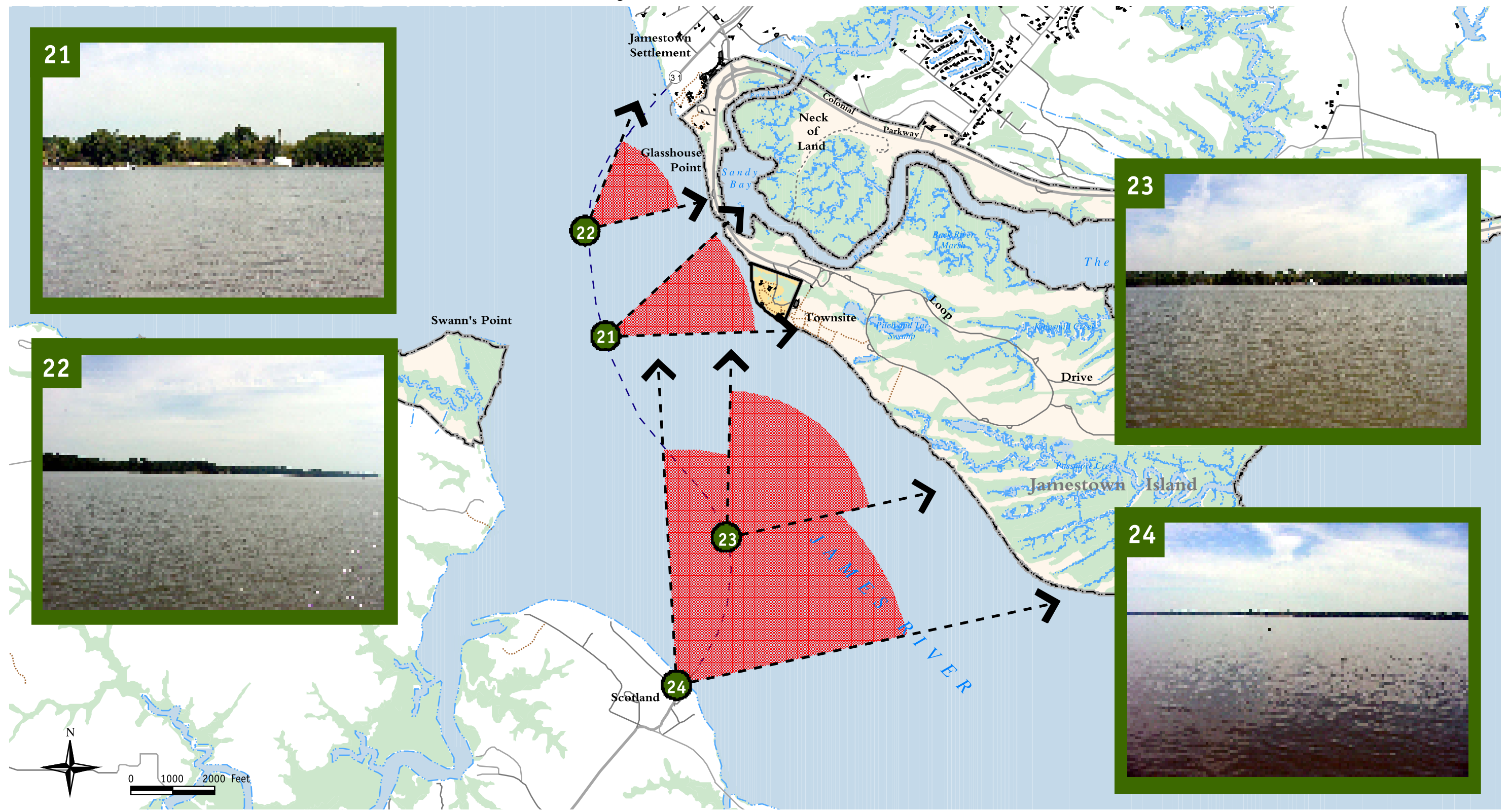
Figure 3-23: Established Viewsheds 14-17

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Figure 3-24: Established Viewsheds 18-20

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Legend

- Wetlands
- Colonial National Historical Park
- Association for the Preservation of Virginia Antiquities

Figure 3-25: Established Viewsheds 21-24

Views to Jamestown Island from the ferry landing at Surry County and from the James River.

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Viewshed 14

The Visitor Center parking lot is also considered part of the Colonial Parkway. As the visitor reaches the parking lot, the views are enclosed by vegetation. The trees in the parking lot contribute significantly to this sense of enclosure. General parking is visible first, and bus parking becomes visible from the middle of the lot. From the west end of the parking lot, the small comfort facility is visible, as are signs to the Visitor Center.

Viewshed 15

From the north edge of the Visitor Center parking lot (technically part of the Parkway) and access road, there is an unobstructed viewshed to Back River and Neck of Land. This viewshed includes boat traffic on Back River, the marshes and vegetation on Neck of Land, and high grasses surrounding the old road trace. This can also be considered a viewshed from the Island.

Viewsheds from the Island

Viewsheds 16 and 17

Once the visitor reaches Jamestown Island, there are established viewsheds to the James River. Major views exist from the Ludwell Statehouse Group, Dale House, the 1607 James Fort Site, and the Memorial Church (Viewshed 16). Constant visual contact with the James River exists while on Jamestown Island. Viewshed 17 includes the views from the walkway along the edge of the Island. This walkway continues through New Towne. All of these views from the Island include Surry County and the development along the banks of the James River. The viewshed to Surry County is immense and constant from Jamestown Island.

Viewsheds on the Island

Viewsheds 18 and 19

From the vicinity of the existing Visitor Center and 1907 monument, there are views over New

Towne, obstructed only by sporadic tree clusters. The site is open and visible, sometimes with the James River in the distance (Viewshed 18). The view west from the 1907 monument (Viewshed 19) includes open views to historic structures, open space, and the Jamestown Rediscovery™ Center.

Viewsheds from Glasshouse Point

Viewshed 20

The northwestern Colonial NHP property line separates Glasshouse Point from the Jamestown Settlement. The Settlement architecture (including new construction) and the reconstructed fort are visible from the Glasshouse parking lot, especially during the fall and winter.

Viewsheds from Surry County

Viewsheds 21, 22, 23, and 24

The entire southern and western edge of Jamestown Island is visible from Surry County. The isthmus and Glasshouse Point are also visible from Surry. Natural features of the Island dominate the viewsheds; however, the “white onion dome” covering an archaeological site is also visible, as are the seawall, the 1607 James Fort Site with wooden posts, and several monuments and buildings. The Dale House is the building closest to the edge of the Island and is the most visible from Surry County and the James River. The 1907 obelisk and the sculpture of John Smith are the most visible monuments.

Viewsheds from the James River

Viewsheds 21, 22, 23, and 24

These same viewsheds exist from the James River, but the views are clearer and more dominant than from the banks of Surry County. Views from the James may vary, as boats can get closer to the Island and views onto the Island become more defined.

Scenic Rivers

No federal wild and/or scenic rivers are located within the Jamestown Project site. However, the portion of the James River that flows by the project site is designated as a “historic river with noteworthy scenic and ecological qualities” (Title 10.1-419). State rivers or sections of rivers possessing scenic, recreational, and/or historic attributes or natural beauty are designated as such by the General Assembly, according to the State Scenic Rivers Act (Title 10.1-400 et seq.). The director of the Virginia Department of Conservation and Recreation is responsible for the protection of scenic rivers and their attributes. As identified in the legislation, this scenic portion of the James covers approximately 25 miles and extends “from an unnamed tributary approximately 1.2 miles east of Trees Point in Charles City County (northside) and Upper Chippokes Creek (southside) to Grices Run (northside) and Lawnes Creek (southside)” (Title 10.1-419) (Figure 3-26). Based on consultations with VDCR, existing viewsheds to and from the James River should be documented and preserved.

Scenic Roads

Route 614 (Green Spring and Centerville Roads), Route 5, Alternate Route 5, Route 31 (Jamestown Road), and the Colonial Parkway have been designated “Community Character Corridors” by James City County in an effort to protect adjacent scenic vistas (Figure 3-27).

Community Character Corridors include “greenbelt” roads, or those roads with adjacent natural or vegetated areas; community gateway or entrance corridors; historic roads; and roads which reveal traditional or unique features of the county recognized in previous comprehensive plans.

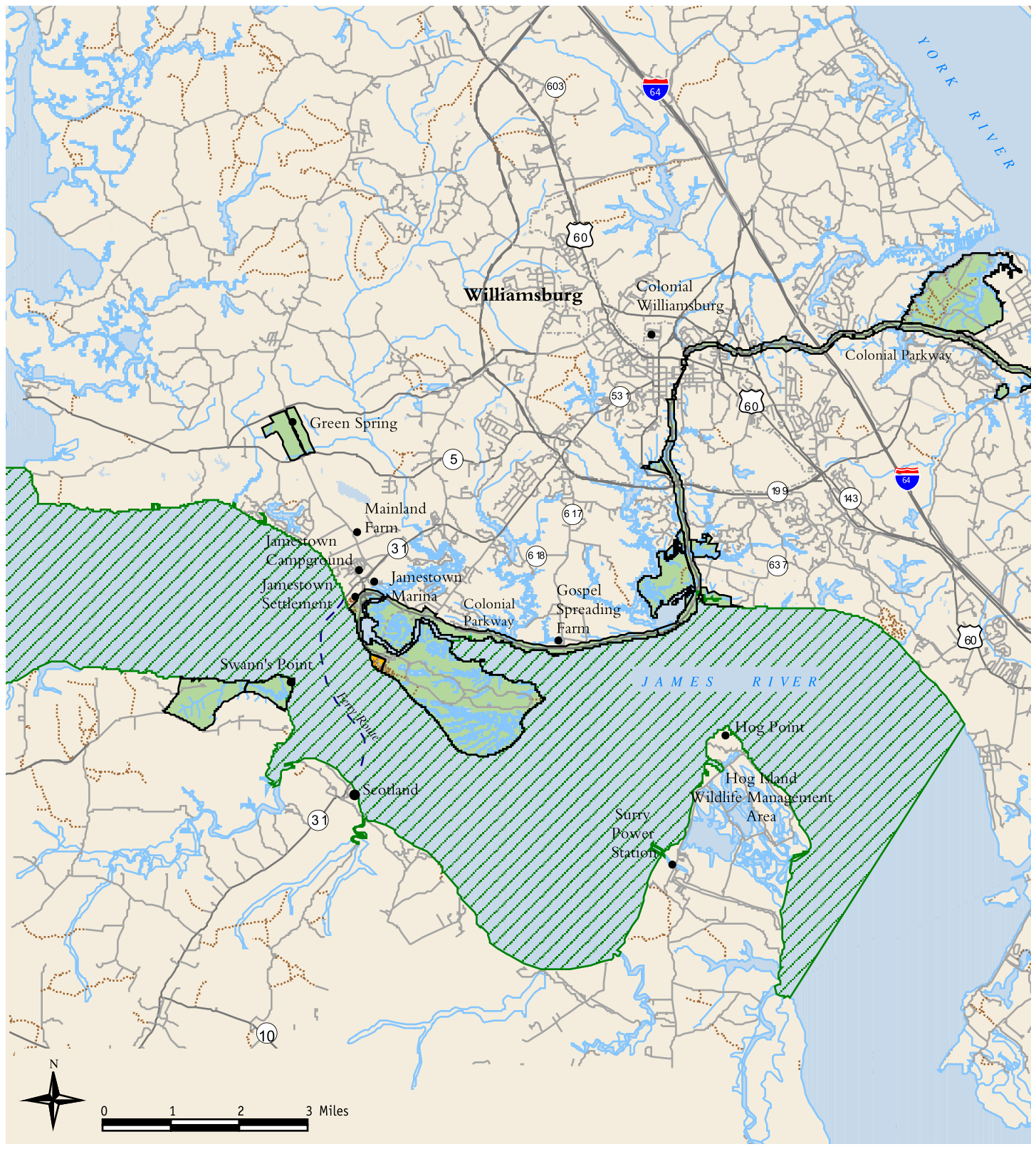
The *James City County 1997 Comprehensive Plan* recommends that these roads receive the highest level of protection for their special characteristics. The county will carefully scrutinize plans that could impact these corridors, making recommendations regarding the visual treatment of community entrance areas, greenbelt roads, and

historic roads. The county may require that a developer alter the design of a project to protect the scenic character of the road. The design revisions may include maintenance of a 150-foot vegetated buffer, use of setbacks, compatible architectural features, signage controls, site layout, and other changes in aesthetics.

In addition, Routes 5, 614, and 359 have been designated by the Virginia Department of Transportation (VDOT) as Scenic Byways (Figure 3-27). This designation recognizes the historical, natural, or recreational significance of a roadway. Protection measures for Scenic Byways are enacted at the locality’s discretion, and the designation may be revoked if the road does not continue to meet the standards for inclusion in the byway program. On the other hand, a Scenic Highway is located within a protected corridor and has been located, designed, and constructed to preserve and enhance the natural beauty and cultural value of the countryside. The Colonial Parkway is the county’s sole recipient of VDOT’s Scenic Highway designation (JCC 1997) (Figure 3-27).

3.3.2.13 Air Quality

This section describes existing conditions in order to evaluate the changes in air quality due to motor vehicle traffic associated with the implementation of the Jamestown Project alternatives. The 1990 Clean Air Act Amendments (CAAA) and the Virginia State Implementation Plan (SIP) require that a proposed project not cause any new violation of the National Ambient Air Quality Standards (NAAQS), nor increase the frequency or severity of any existing violations, nor delay attainment of any NAAQS. Air quality is a concern for the Jamestown Project area because poor air quality can adversely affect visitors, wildlife, and vegetation. Pollution levels of carbon monoxide (CO) and ozone that exceed the NAAQS may cause health problems for some visitors.



Legend




-  Scenic River
-  Colonial National Historical Park
-  Association for the Preservation of Virginia Antiquities

Figure 3-26: Scenic Portion of the James River



Legend

- Scenic Byway
- Federal Scenic Highway
- General Access
- James City County Community Character Corridors

Figure 3-27: Scenic Byways, Highways and Community Character Corridors

Source: James City County 1997 Comprehensive Plan and A Map of Scenic Roads in Virginia, VDOT, 1998

The Colonial NHP *Air Quality Management Plan* defines air quality related values (AQRVs) as “those values possessed by an area which are or could be affected by changes in air quality. AQRVs include visibility and scenic, cultural, biological, and recreational resources. Resources which may be adversely affected by changes in air quality are visibility, vegetation, wildlife, water quality, soils, historic and archaeological objects and resources, and visitor enjoyment” (NPS 1991a). The National Park Service Organic Act of August 25, 1916, requires the National Park Service to protect all resources within park boundaries.

The air quality study evaluates the CO and ozone precursor impacts from project-related traffic, the primary source of CO and ozone precursor emissions at the Jamestown Project. There are two components to this study, a microscale analysis and a mesoscale analysis. The microscale analysis evaluates the local CO concentrations at sensitive receptor locations. The mesoscale analysis evaluates the regional ozone precursor emissions of volatile organic compounds (VOCs) and nitrogen oxides (NOx). The results of the air quality study demonstrate that the existing conditions do not interfere with the attainment or maintenance of the state and federal air quality standards for CO and ozone in the study area. These results are also consistent with the study area’s attainment designation for CO and ozone.

Air Quality Standards

The federal Environmental Protection Agency has set the NAAQS for CO and ozone to protect the public health. The Commonwealth of Virginia has adopted the same standards as those set by the EPA. The standards set maximum concentrations of CO at 35 parts per million (ppm) for a one-hour period and 9 ppm for an eight-hour period, each not to be exceeded more than once per year. For ozone, the current NAAQS is 0.12 ppm for an eight-hour period, not to be exceeded more than three times over a continuous three-year period. EPA has now adopted an eight-hour standard with a level of

0.08 ppm to provide greater protection to public health than the current standard.

The predominant source of pollution anticipated from the proposed project is emissions from project-related motor vehicle traffic. Carbon monoxide is directly emitted by motor vehicles. Impacts of CO can be estimated by using a computer model to predict CO concentrations, which can then be compared to the NAAQS. Ozone is not directly emitted by mobile sources, nor will it be emitted by other project-related activity. The ozone impacts of the project are evaluated by assessing changes in ozone precursor emissions (VOCs and NOx).

Modeling Methodology

The air quality study is consistent with EPA modeling procedures. The microscale analysis calculated maximum CO concentrations at receptor locations for four intersections for existing (2001) conditions. The 2001 existing conditions represent current traffic conditions in the study area.

Microscale Analysis

The objective of the microscale analysis was to evaluate CO concentrations at congested intersections in the study area during the peak CO season (winter). The intersections in the study area were ranked based on traffic volumes and level of service. The following intersections were selected for the air quality study because they would be most affected by project-related traffic in the study area (Figure 3-28):

- State Route 31 (Jamestown Road) and State Route 359,
- Colonial Parkway and State Route 359,
- Route 31 (Jamestown Road) and State Route 199, and
- Colonial Parkway and State Route 199.

The microscale analysis calculates maximum one-hour and eight-hour CO concentrations. The EPA's CAL3QHC Version 2 computer model was used to

predict CO concentrations at receptor locations. The CAL3QHC model calculates the air quality impacts from vehicles in both free-flow and idle operation by creating a three-dimensional model that represents the roadway and receptor geometry. Traffic, emission, and meteorological data were entered into the model to predict maximum one-hour CO concentrations at the receptor locations. The receptor locations were placed in areas where the public has access. Typically, the receptor locations were placed at the edge of the roadway, but not closer than 10 feet from the nearest travel lane so that they were not within the roadway-mixing cell. The results of the microscale analysis are presented in Tables 3-26 and 3-27. These values represent the highest concentrations for each intersection. Receptor locations placed farther from the intersections will have lower concentrations because of CO dispersion characteristics. Receptors that are along major roadways (Route 31 and the Colonial Parkway) are also expected to have lower CO concentrations, because the emission factors for vehicles traveling along these roadways are much lower than the emission rates for vehicles waiting at intersections.

Mesoscale Analysis

The objective of the mesoscale analysis was to estimate the area-wide emissions of VOCs and NOx during a typical day in the ozone season (summer). The mesoscale study area includes the area roadways that would be impacted by site-generated traffic (Figure 3-29). Vehicle emissions in the study area were estimated by conducting a pollution-burden analysis that used average daily volumes, lengths of roadways, and vehicle emissions.

Traffic Data

Motor vehicle emissions are the predominant project-related sources of CO emissions and ozone precursor emissions. The microscale analysis used evening peak-hour traffic conditions that were representative of the peak CO season (winter). The mesoscale analysis was based on the average daily traffic conditions during the peak ozone season

(summer). Vehicle speeds were developed based on posted speed limits and travel speed observations made during peak traffic periods. The traffic data used in the air quality analyses were derived from the traffic impact assessment as described in the “Transportation and Site Access” section of this document.

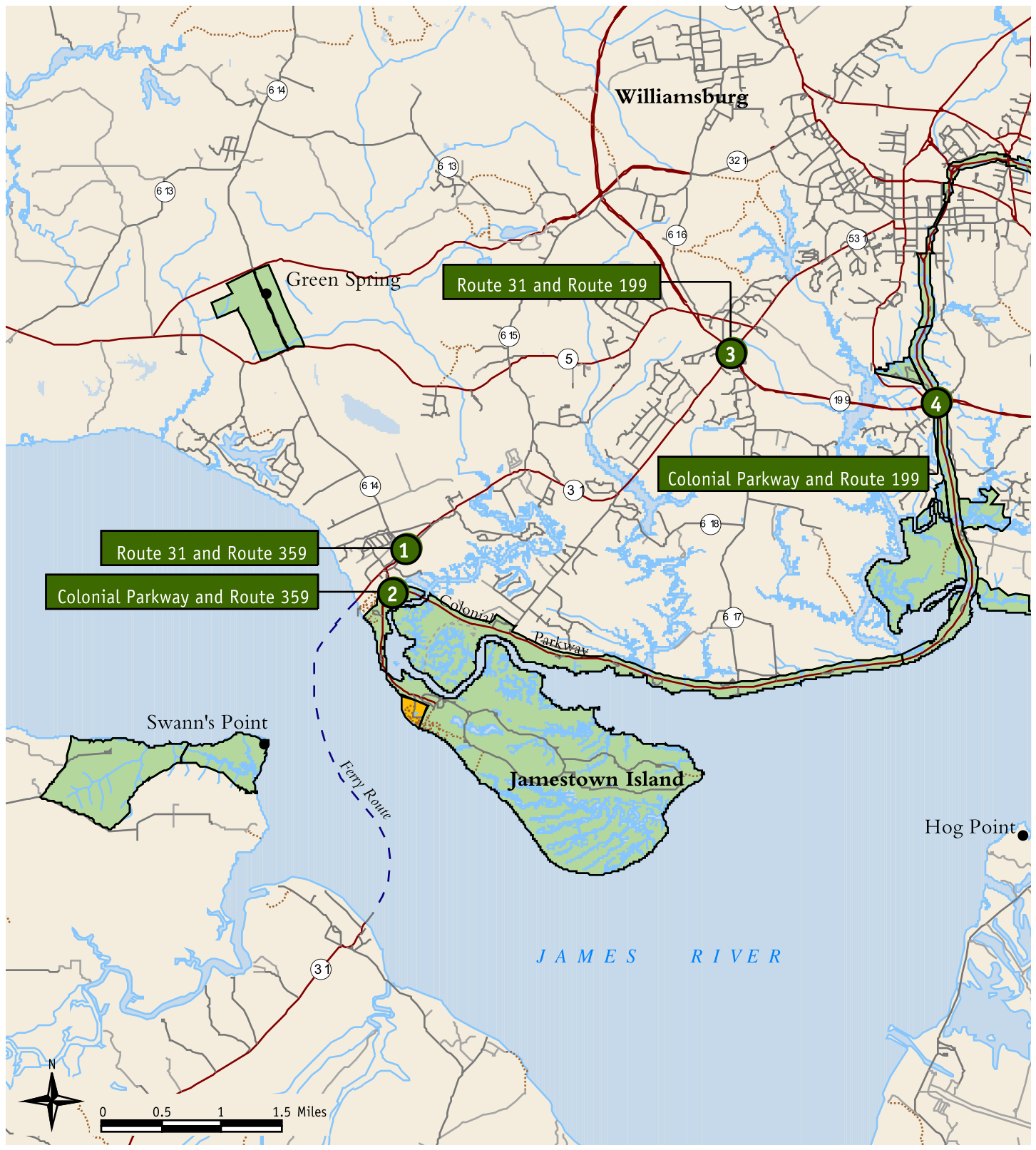
Emission Factors

The vehicle emission factors used in the microscale and mesoscale analyses were obtained using the EPA MOBILE5b computer model. MOBILE5b calculates CO, VOC, and NOx emission factors for motor vehicles in grams per vehicle-mile. The emission factors calculated in this study were adjusted to reflect conditions specific to James City County and temperatures representative of the winter CO season and the summer ozone season.

Existing Conditions

The Clean Air Act Amendments resulted in states being divided into attainment and nonattainment areas, with classifications based upon the severity of their air quality problems. The proposed project is located in James City County, which is an area designated as attainment for both ozone and carbon monoxide.

The microscale analysis demonstrated that the 2001 one-hour CO concentrations ranged from a minimum of 4.5 ppm at the intersection of Colonial Parkway and Route 359 to a maximum of 9.2 ppm at the intersection of Route 31 and Route 199. The corresponding maximum eight-hour CO concentrations ranged from a minimum of 3.2 ppm to a maximum of 6.4 ppm. The microscale results for all the receptor locations are presented in Tables 3-26 and 3-27. All the one-hour and eight-hour concentrations are below the standards for CO of 35 and 9 ppm, respectively.



Legend

- Colonial National Historical Park
- Association for the Preservation of Virginia Antiquities

Figure 3-28: Air Quality - Microscale Intersections



Legend

- Mesoscale Link
- Colonial National Historical Park
- Association for the Preservation of Virginia Antiquities

Figure 3-29: Air Quality - Mesoscale Links

Table 3-26: Predicted Maximum One-Hour CO Concentrations*

| Receptor Location | 2001 Existing** |
|--|-----------------|
| State Route 31 (Jamestown Road) and State Route 359 | |
| 1. West side of Route 31 | 5.3 |
| 2. Jamestown Settlement parking lot (west side) | 5.4 |
| 3. Jamestown Settlement Visitor's Center (west side) | 5.3 |
| Colonial Parkway and State Route 359 | |
| 1. East side of Colonial Parkway | 4.5 |
| 2. Jamestown Settlement parking lot (east side) | 5.4 |
| 3. Jamestown Settlement Visitor's Center (east side) | 4.8 |
| State Route 31 (Jamestown Road) and State Route 199 | |
| 1. Prudential realty office | 9.2 |
| 2. CVS convenience store and pharmacy | 8.8 |
| 3. SunTrust Bank and office park | 8.5 |
| 4. 7-Eleven convenience store | 8.3 |
| Colonial Parkway and State Route 199 | |
| 1. Open space northeast quadrant | 5.9 |
| 2. Open space southeast quadrant | 6.3 |
| 3. Open space southwest quadrant | 6.6 |
| 4. Open space northwest quadrant | 5.3 |

Notes: *The concentrations are expressed in parts per million (ppm) and include a one-hour background concentration of 3.0 ppm.
 **The one-hour NAAQS for CO is 35 ppm.

Table 3-27: Predicted Maximum Eight-Hour CO Concentrations*

| Receptor Location | 2001 Existing** |
|--|-----------------|
| State Route 31 (Jamestown Road) and State Route 359 | |
| 1. West side of Route 31 | 3.7 |
| 2. Jamestown Settlement parking lot (west side) | 3.8 |
| 3. Jamestown Settlement Visitor's Center (west side) | 3.7 |
| Colonial Parkway and State Route 359 | |
| 1. East side of Colonial Parkway | 3.2 |
| 2. Jamestown Settlement parking lot (east side) | 3.8 |
| 3. Jamestown Settlement Visitor's Center (east side) | 3.4 |
| State Route 31 (Jamestown Road) and State Route 199 | |
| 1. Prudential realty office | 6.4 |
| 2. CVS convenience store and pharmacy | 6.2 |
| 3. SunTrust Bank and office park | 6.0 |
| 4. 7-Eleven convenience store | 5.8 |
| Colonial Parkway and State Route 199 | |
| 1. Open space northeast quadrant | 4.1 |
| 2. Open space southeast quadrant | 4.4 |
| 3. Open space southwest quadrant | 4.6 |
| 4. Open space northwest quadrant | 3.7 |

Notes: *The concentrations are expressed in parts per million (ppm). The eight-hour concentrations were calculated using a persistence factor of 0.7.
 **The eight-hour NAAQS for CO is 9 ppm.

The mesoscale analysis calculated the 2001 VOC and NOx emissions from major roadways in the study area. These emissions were estimated to be 1,707.5 kilograms per day (kg/day) of VOCs and 2,443.4 kg/day of NOx. These emissions establish a baseline to which future emissions and changes in emissions can be compared. Table 3-28 presents the mesoscale analysis results.

Table 3-28: Mesoscale Analysis Results (Kilograms per Day)

| Pollutant | 2001 Existing* |
|----------------------------------|----------------|
| Volatile Organic Compounds (VOC) | 1,707.5 |
| Nitrogen Oxides (NOx) | 2,443.4 |

Source: Vanasse Hangen Brustlin, Inc.

3.3.2.14 Noise

The purpose of this section is to provide existing conditions information necessary to evaluate the changes in sound levels due to implementation of Jamestown Project alternatives associated with project-related motor vehicle traffic. Noise is a concern to the Jamestown Project area because it can interfere with communications and the visitor experience, bother surrounding neighborhoods, and potentially disrupt wildlife activities. The National Park Service Organic Act of August 25, 1916, requires the National Park Service to protect all resources within park boundaries. This noise analysis followed the Federal Highway Administration (FHWA) noise impact assessment procedures and criteria because the predominant project-related noise sources are motor vehicles.

Noise Background

Noise is defined as unwanted or excessive sound. Sound becomes unwanted when it interferes with normal activities such as sleep, work, or recreation. Individual human responses to noise are subject to considerable variability since many emotional and physical factors affect reactions to noise.

Sound and noise are described in terms of loudness, frequency, and duration. Loudness is the sound pressure level measured on a logarithmic scale in units of decibels (dB). For community noise impact assessment, sound level frequency characteristics are based upon human hearing, using an A-weighted (dBA) frequency filter. The A-weighted filter is used because it best approximates the way humans hear sound. The duration characteristics of sound account for the time-varying nature of sound sources. Table 3-29 lists common indoor and outdoor sound levels.

The most common way to account for the time-varying nature of sound (duration) is through the equivalent sound level measurement, referred to as Leq. The Leq averages the background sound levels with short-term transient sound levels and provides a uniform method for comparing sound levels that vary

over time. The time period used for highway noise analysis is typically one hour. The peak-hour Leq represents the noisiest hour of the day/night and usually occurs during the peak periods of automobile and truck traffic. The FHWA guidelines and criteria require the use of the one-hour Leq for assessing highway noise impacts on different land uses.

The following general relationships exist between hourly traffic noise levels and human perception. They are expressed in terms of dBAs.

- A 1 or 2 dBA increase/decrease is not perceptible to the average person.
- A 3 dBA increase/decrease is a doubling/halving of acoustic energy, but is just barely perceptible to the human ear.
- A 10 dBA increase/decrease is a tenfold increase/decrease in acoustic energy, but is perceived as a doubling/halving in loudness to the average person.

The FHWA has established noise abatement criteria to help protect the public health and welfare from excessive vehicle traffic noise. Traffic noise can adversely affect human activities such as communication. Recognizing that different areas are sensitive to noise in different ways, the FHWA has established Noise Abatement Criteria (NAC) according to land use. The criteria are described in Table 3-30. The FHWA procedures consider a receptor location to be impacted by noise when existing or future sound levels approach (within 1 dBA), are at, or exceed the NAC, or when future sound levels exceed existing sound levels by a substantial amount. It is generally considered that a 0-3 dBA increase/decrease represents a slight change in noise levels, a 4-8 dBA increase/decrease represents a moderate change in noise levels, and a 9 dBA or greater increase/decrease represents a substantial change in noise level.

Table 3-29: Indoor and Outdoor Sound Levels

| Outdoor Sound Levels | Sound Pressure (μ PA) | | Sound Level (dBA) | Indoor Sound Levels |
|------------------------------|-------------------------------|---|----------------------|--|
| Jet Over-Flight at 300 m | 3,324,555 | – | 110 | Rock Band at 5 m |
| | | – | 105 | |
| | 2,000,000 | – | 100 | Inside New York Subway Train |
| Gas Lawn Mower at 1 m | | – | 95 | |
| | 632,456 | – | 90 | Food Blender at 1 m |
| Diesel Truck at 15 m | | – | 85 | |
| Noisy Urban Area – Daytime | 200,000 | – | 80 | Garbage Disposal at 1 m |
| | | – | 75 | |
| Gas Lawn Mower at 30 m | 63,246 | – | 70 | Vacuum Cleaner at 3 m |
| Suburban Commercial Area | | – | 65 | Normal Speech at 1 m |
| | 20,000 | – | 60 | |
| Quiet Urban Area – Daytime | | – | 55 | Quiet Conversation at 1 m |
| | 6,325 | – | 50 | |
| Quiet Urban Area – Nighttime | | – | 45 | Dishwasher Next Room |
| | 2,000 | – | 40 | |
| Quiet Suburb – Nighttime | | – | 35 | Empty Theater or Library |
| | 632 | – | 30 | |
| Quiet Rural Area – Nighttime | | – | 25 | Quiet Bedroom at Night Empty Concert Hall |
| Rustling Leaves | 200 | – | 20 | |
| | | – | 15 | Broadcast and Recording Studios |
| | 63 | – | 10 | |
| | | – | 5 | |
| Reference Pressure Level | 20 | – | 0 | Threshold of Hearing |

Notes: μ Pa = MicroPascals describe pressure. The pressure level is measured by sound level monitors.
 DBA = A-weighted decibels describe pressure logarithmically with respect to 20 μ Pa (the reference pressure level)
 Source: Highway Noise Fundamentals, Federal Highway Administration, September 1980.

**Table 3-30: Noise Abatement Criteria (NAC)
One-Hour, A-Weighted Sound Levels in
Decibels (dBA)**

| Activity Category | L _{eq} (h)* | Description of Activity Category |
|-------------------|----------------------|--|
| A | 57 (Exterior) | Lands on which serenity and quiet are of extraordinary significance and serve an important public need and where the preservation of those qualities is essential if the area is to continue to serve its intended purposes. |
| B | 67 (Exterior) | Picnic areas, recreation areas, playgrounds, active sports areas, parks, residences, motels, hotels, schools, churches, libraries, and hospitals. |
| C | 72 (Exterior) | Developed lands, properties, or activities not included in Categories A or B above. |
| D | — | Undeveloped lands |
| E | 52 (Interior) | Residences, motels, hotels, public meeting rooms, schools, churches, libraries, hospitals, and auditoriums. |

Notes: *L_{eq}(h) is an energy-averaged, one-hour, A-weighted sound level in decibels (dBA).

Source: 23 CFR Part 772 – *Procedures for Abatement of Highway Traffic Noise and Construction Noise*.

Modeling Methodology

The noise analysis evaluated the study area to identify receptor locations that have outdoor activities, which might be sensitive to highway noise, including areas along the major access routes (Colonial Parkway and State Route 31) to the Jamestown Project site. These receptor locations included the Jamestown Project site, the Jamestown Settlement, residences, and public buildings (Figure 3-30). The majority of these land uses fall into the FHWA's Activity Category B, which has a noise abatement criterion of 67 dBA.

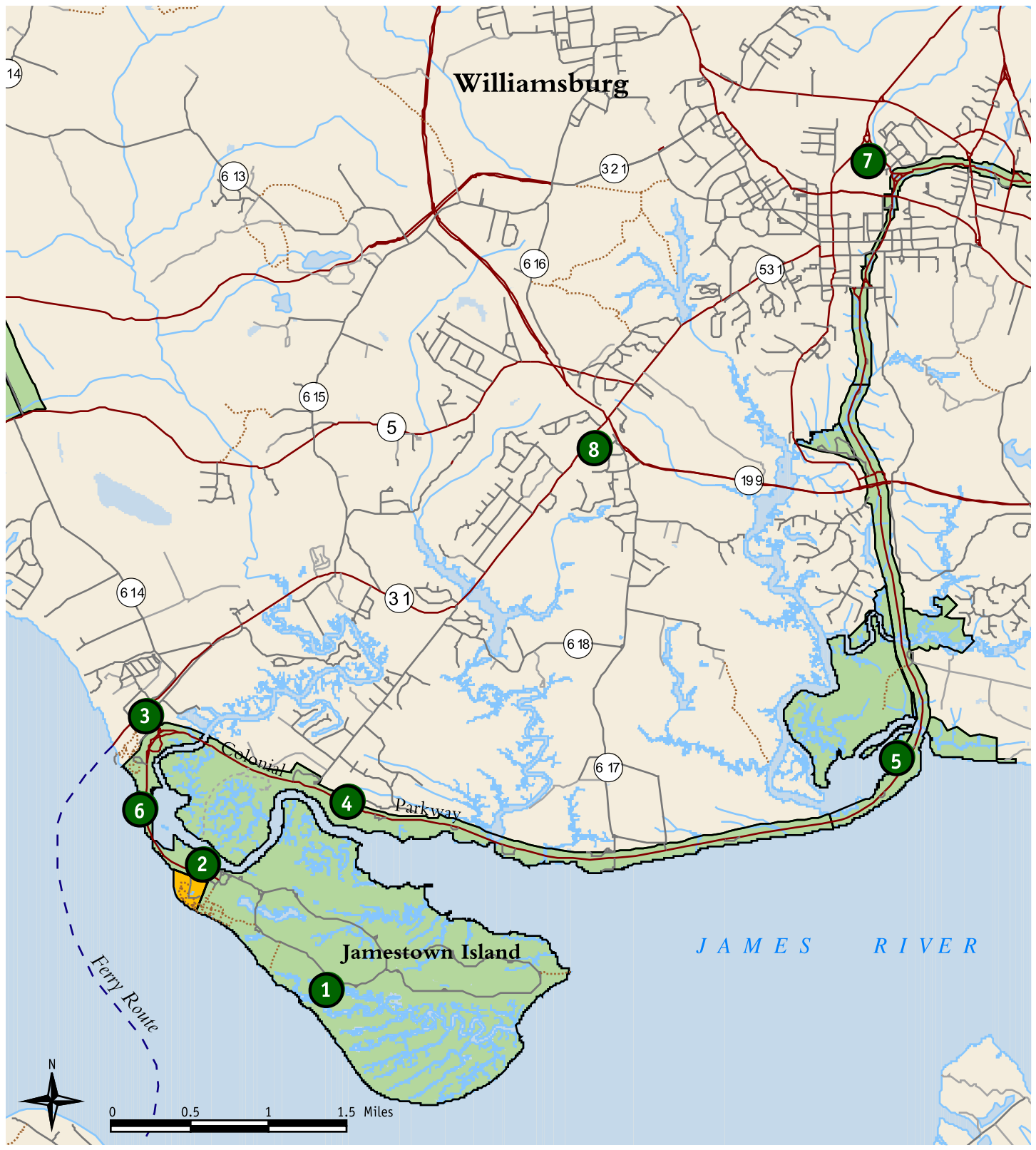
Sound levels were measured at eight receptor locations during afternoon periods in March 2001 in conformance with the FHWA noise monitoring guidelines. Sound level data were obtained in conjunction with the traffic data. The dominant source of noise in the study area was vehicles traveling on the Colonial Parkway and State Route 31.

The purposes of collecting the sound level and traffic data at the monitoring sites were to establish the existing sound levels in the study area and to calibrate the noise prediction model for future years and analysis of project alternatives.

Existing Conditions

A noise monitoring program was conducted to establish the existing sound levels in the study area. These sound levels ranged from 51 dBA to 69 dBA (Leq). These numbers are typical for residential and recreational areas with moderate automobile and bus traffic. The existing sound levels varied depending upon traffic volumes, number of buses, and the distance from the receptor location to the noise sources. The noise monitoring results provide existing sound levels that can be compared to future predicted sound levels. Future sound levels will be developed for each of the project alternatives to determine noise impacts and to evaluate noise mitigation measures. The results of the noise monitoring program are presented in Table 3-31.

The results of the noise monitoring program demonstrate that the existing sound levels are dominated by roadway traffic. Military jet over-flights occur occasionally, increasing sound levels temporarily, but do not have an impact on the overall sound levels of the Island. No jets flew over during noise monitoring. The receptor locations at the Jamestown Project site (receptor locations 1, 2, and 6) experienced sound levels that ranged from 51 to 65dBA. The receptor locations along the Colonial Parkway (receptor locations 4 and 5) experienced sound levels that ranged from 51 and 64 dBA. The sound levels at the Jamestown Settlement (receptor location 3) were 65 dBA, which approach the federal Noise Abatement Criteria due to the high bus traffic. Receptor location 8 represents residences along State Route 31. The highest sound levels were measured at the Colonial Williamsburg Visitor Center area along Route 132Y (receptor location 7) with sound levels of 69 dBA, due to high traffic volumes.



Legend

- 1 Noise Monitors
- Colonial National Historical Park
- Association for the Preservation of Virginia Antiquities

Figure 3-30: Noise Quality - Monitor Locations

Note: Noise monitor numbers correspond to Table 3-31: Noise Monitoring Data

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Table 3-31: Noise Monitoring Data

| Receptor Number | Receptor Location | L _{eq} Measured | FHWA Criterion |
|-----------------|---|--------------------------|----------------|
| 1 | Jamestown Island Loop Drive | 51 | 57 |
| 2 | Jamestown Island parking area | 53 | 67 |
| 3 | Jamestown Settlement – Route 31 at Route 359 | 65 | 67 |
| 4 | Residences at Back River Lane | 51 | 67 |
| 5 | Colonial Parkway at College Creek | 64 | 67 |
| 6 | Colonial Parkway at the isthmus pull-off | 65* | 67 |
| 7 | Colonial Williamsburg Visitor Center – Route 132Y | 69 | 67 |
| 8 | Route 31 at Old Colony Lane | 62 | 67 |

Notes: Source: Vanasse Hangen Brustlin, Inc.

* Wind noise was a substantial noise source at this location

3.3.2.15 Hazardous Materials/Contamination

The purpose of this section is to identify known hazardous materials, including asbestos-containing materials (ACM), lead-based paint (LBP), and oil and other hazardous materials (OHMs), located at the 14 buildings designated for possible renovation or demolition. State and federal environmental databases, available building and site diagrams, and NPS storage tank files were reviewed. The file review was limited to materials provided by the APVA and the NPS and the limitations of the Environmental Data Resources, Inc., (EDR) report.

A site reconnaissance was also performed, including an ACM and LBP survey and a general walkover, to determine existing conditions in the study area. The results from the hazardous materials survey were submitted to the APVA and the NPS in Technical Summary letter reports dated August 2, 2001, and a Technical Memorandum dated August 2, 2001. The hazardous materials survey was conducted at the following Jamestown area buildings:

- NPS/APVA Visitor Center,
- Footbridge restrooms,
- Harrington House,
- NPS ranger entrance station,

- Ranger entrance booths 1 and 2,
- NPS maintenance office and storage bays,
- NPS maintenance fire cache and storage bays,
- NPS maintenance carpenter shop and storage shed,
- APVA storage facility,
- APVA Mule Barn/Restoration Shop,
- APVA Dale House,
- APVA Yeardley House/Jamestown Rediscovery™ Center, and
- NPS ranger's quarters.

Methodology

In conjunction with Vanasse Hangen Brustlin, Inc. (VHB), accredited inspectors from Industrial Training Company (ITC) performed the survey for asbestos and lead on May 14 and 15, 2001. Because the buildings were occupied, the surveys were limited to accessible and observable areas. The inspection for suspect ACM was conducted by ITC in general accordance with guidelines published by the Environmental Protection Agency's Asbestos Hazard Emergency Response Act (AHERA) (40 CFR, Part 763, Subpart E) and National Emission Standards for Hazardous Air Pollutants (NESHAPS) (40 CFR Part 61, Subpart M). Sampling procedures included the collection of at least two

samples of all identified suspect homogeneous and nonfriable materials from the areas surveyed. The survey for suspect ACM consisted of visual inspection, sampling, and laboratory analyses. The inspection included both friable (easily crumbled) and nonfriable suspect materials. Sample analyses were performed at Scientific Laboratories, Inc., in Midlothian, Virginia. Bulk sample analysis was performed using Polarized Light Microscopy with Dispersion Staining (PLM/DS) in accordance with EPA protocol (40 CFR, EPA Method 600/R093/116, July 1993).

The LBP inspection was conducted by field screening all painted surfaces potentially affected by renovation/demolition activities using a NITON X-ray Fluorescence (XRF) Spectrum Analyzer and collecting composite soil samples. The Virginia Department of Occupation and Regulation (VDOR) categorizes surfaces testing greater than 1.0 milligrams of lead per square centimeter ($>1.0 \text{ g/cm}^2$) as lead-based paint. Surficial soil samples were collected along the perimeter of buildings (drip lines from the roof) whose exterior was identified as contaminated and damaged (peeling and flaking). Soil samples were typically collected within 6 inches of the soil surface. Soil sample analysis was performed using Atomic Absorption Spectrometry (AAS) in accordance with EPA protocol (40 CFR, EPA Method 600/R093/200). Soil samples containing greater than 400 parts per million (ppm) lead are considered EPA levels of concern for high-contact areas.

Asbestos-containing Materials (ACM)

A total of 293 samples were collected and submitted for laboratory analysis from the buildings surveyed. Table 3-32 summarizes the location, description, approximate size, and condition of ACMs identified in the survey. Material classified as nonfriable is considered by EPA's NESHAP as either Category I (packings, gaskets, resilient floor coverings, or asphaltic materials) or Category II (all other nonfriable materials).

Lead-based Paint (LBP)

Table 3-33 summarizes the locations, descriptions, and conditions of lead-based paint materials identified in the survey. If renovation activities do not affect LBP-coated building components, no further work needs to be conducted. If specific buildings will be demolished that are constructed of building components coated with LBP, sampling using the toxicity characteristic leachate procedure (TCLP) is required by EPA Resource Conservation and Recovery Act (RCRA) regulations (40 CFR, Part 261, Subpart C). If the results of TCLP testing indicate results greater than 5.0 milligrams per liter, the waste is classified as RCRA-Hazardous and must be packaged, transported, and disposed of as hazardous waste.

In addition, eight samples of suspect LBP-contaminated soil were collected and submitted for laboratory analyses from the following buildings:

- APVA Mule Barn/Restoration Shop (two samples),
- APVA Dale House (two samples),
- APVA Yeardley House/Jamestown Rediscovery™ Center (two samples), and
- Harrington House (two samples).

The results indicate that only one sample collected from the Dale House exceeded the EPA level of concern for high-contact areas.

Oil and/or Other Hazardous Materials (OHM)

A survey for miscellaneous containers of oil and/or other hazardous materials was performed to identify all regulated and special wastes that would require removal prior to building renovation/demolition. The majority of the OHM identified were miscellaneous containers used for cleaning/housekeeping, landscape vehicles/equipment, vehicle maintenance operations, and refrigeration/air conditioning equipment.

Table 3-32: Asbestos-Containing Materials

| Building | Material Description | Material Location | Approximate Material Size | Friable | Material Condition |
|--|--|---|---------------------------|---------|--------------------|
| NPS/APVA Visitor Center | White boiler gasket | Boiler Room | 2 sq. ft. | No | Good |
| | Gray HVAC ductwork jacketing | Archive Room | 1,000 sq. ft. | No | Fair |
| | Drywall* | Basement Rear Entry Hall | 7,000 sq. ft. | Yes | Good |
| | Blue and white 12" x 12" floor tile and mastic adhesive* | Rear Entry Hall, Projector Room, Theatre 1, and Gift Shop Storage Room | 1,050 sq. ft. | No | Fair |
| | White spray-applied ceiling plaster | Offices, Exhibit Area, and Main Lobby Area | 8,000 sq. ft. | Yes | Fair |
| Footbridge rest rooms | Black asphalt roof flashing | Exterior Roof | 120 linear ft. | No | Fair |
| | Black asphalt flat roofing material | Exterior Roof | 750 sq. ft. | No | Fair |
| Harrington House | Beige and white 9" x 9" floor tile | Beneath existing white and blue 12" X 12" floor tile in break room and storage room | 500 sq. ft. | No | Fair |
| | Black asphalt roof flashing cement | Exterior roof | 6 sq. ft. | No | Good |
| NPS ranger entrance station | Gray and white 12" x 12" floor tile and associated mastic adhesive** | Main office | 600 sq. ft. | No | Good |
| NPS ranger entrance booth 1 | Gray and white 12" x 12" floor tile and associated mastic adhesive** | Booth floor | 120 sq. ft. | No | Good |
| NPS ranger entrance booth 2 | Gray and white 12" x 12" floor tile and associated mastic adhesive** | Booth floor | 120 sq. ft. | No | Good |
| NPS maintenance office and storage bays | White exterior window and door caulking | Exterior windows and doors | 220 linear ft. | Yes | Fair |
| NPS fire cache and storage bays | Black roof flashing | Roof Penetrations | 30 sq. ft. | No | Fair |
| APVA Yeardley House/ Jamestown Rediscovery™ Center | HVAC insulation mastic | Side porch roof | 500 sq. ft. | Yes | Poor |

Notes: Sq. ft. = Square feet

* Because the PLM (Polarized Light Microscopy) results of the sample indicate the material contains <10%, the sample was also analyzed by the Point Count Method in accordance with EPA NESHAPS. Analytical results indicated that the material contains >1% asbestos and therefore, if it is disturbed, it must be managed as a regulated material.

** Floor tiles are considered contaminated with asbestos mastic for purposes of removal.

Table 3-33: Lead-Based Paint

| Building | LBP Material Description | LBP Material Location | LBP Condition |
|---|---|--|---|
| NPS/APVA Visitor Center | Gray metal stair treads, rail cap, and stringer | Mechanical room | Intact |
| | Black metal stair treads | Theatre #1 | Intact |
| | Black metal stair treads, rail cap, and stringer | Building exterior | Intact |
| | White metal lift station and pump room | Adjacent to exterior of mechanical room entrance | Intact |
| Harrington House | Blue wood entry door casing | Building exterior | Intact |
| | White wood window stool | Kitchen | Intact |
| | Yellow ceramic tile | Restroom | Intact |
| | Green exterior soffits and fascia boards | Building exterior | Intact |
| | Green exterior siding | Original siding beneath existing vinyl siding on building exterior | *Could not be fully accessed |
| NPS maintenance office and storage bays | Beige metal support columns | Storage Bays | Intact |
| | Yellow concrete bollards (guards) | Storage Bays | Intact |
| | Beige wood soffits and ceilings | Storage Bays | Poor (peeling and flaking) |
| APVA Mule Barn/ Restoration Shop | Brown interior and exterior windows and casings | Restoration Shop | Intact on the interior and poor condition on the exterior |
| | Brown wood door | Between upper and lower levels | Intact |
| | Off-white exterior siding | Building Exterior | Poor |
| APVA Yeardley House/Jamestown Rediscovery™ Center | All painted wainscoting | Throughout building | Intact |
| | All original baseboards* | Throughout building | Intact |
| | All windows and casings | Throughout building | Intact |
| | All original door casings* | | |
| | All interior stair stringers, risers, and balusters | Throughout building | Intact |
| | All chair rails and decorative trims | Throughout building | Intact |
| | All fireplace mantles | Throughout building | Intact |
| | Bathroom shelves and medicine cabinets | Upstairs bathroom | Intact |
| | Bedroom closet doors and casings | Upstairs bedrooms | Intact |
| | All original gray clapboard siding* | Building exterior | Intact |
| | All green porch siding | Porch | Intact |
| | All exterior shutters | Building exterior | Intact |
| | All porch floors | Porches | Intact |
| | All porch ceilings | Porches | Intact |
| | All exterior decorative trim | Building exterior | Intact |
| | Front exterior built-in porch benches | Front porch | Intact |
| APVA Dale House | White wood doors and casings | Throughout building | Intact |
| | Original windows and casings | Throughout building | Intact |
| | White wood ceiling and beams | Throughout building | Intact |
| | All exterior painted surfaces | Building exterior | Intact |
| NPS ranger's quarters | All interior white doors | Throughout building | Intact |
| | All painted surfaces | Sunroom | Intact |
| | All white ceilings | Throughout building | Intact |
| | All exterior soffits and fascia boards | Building exterior | Intact |
| | Green ceiling | Garage | Intact |
| | White exterior window casings | Building Exterior | Intact |

Notes: *Original building components show a visibly different paint history (via paint thickness).

A complete list of OHM materials observed during the survey can be found in the Technical Summary letter report dated August 2, 2001. Several building materials are considered OHM, including mercury-containing light tubes and thermostats and PCB-containing light ballasts and/or transformers. Building materials identified as OHM should be properly removed and disposed of in accordance with state and federal regulations.

Several petroleum storage tanks were also identified within the study area. Table 3-34 summarizes the storage tanks that were identified through site reconnaissance and file review activities. According to the NPS *Resource Management Plan* (Colonial NHP 1999), NPS tested all the underground storage tanks (UST) within Colonial National Historical Park (including Yorktown) in 1991 in accordance with state regulations. Although all the tanks passed the inspection, NPS replaced nine USTs in the park.

The following Environmental Data Resources, Inc., environmental databases were also reviewed: the National Priority List; Comprehensive Environmental Response, Compensation and Liability Information System; Corrective Action Report; Resource Conservation and Recovery Information System (RCRIS) Treatment, Storage, and Disposal facilities; RCRIS generators; state list of hazardous waste sites; state list of spill sites; Solid Waste Management facilities (SWF); registered underground storage tanks; registered aboveground storage tanks; leaking underground storage tanks (LUST); Leaking Petroleum Storage Tanks (LTANKS); and public water supplies.

One site on Jamestown Island was identified on the Emergency Response Notification System (ERNS) database. It is designated as "James River near Jamestown Island" but is mapped on Jamestown Island. This is most likely the same ERNS site that was identified in the *Environmental Impact Review/Environmental Site Assessment for Proposed Acquisition* for the Jamestown Settlement parking lot expansion project (Draper Aden Associates 2001). The

Jamestown Rediscovery™ Center/Yearley House and the Jamestown Maintenance Facility are identified on the LTANKS, LUST, and UST databases.

In addition, several James City County lift stations near the project site are also identified on the LTANKS and LUST databases. Lift station 5-1 is listed on the LTANKS and UST list and is located immediately adjacent to the Jamestown NPS Maintenance Facility.

In addition to storage tanks, floor drains were observed in several of the buildings and parking lots. The drains are possible pathways of contamination in case of a release in the area. The sink in the APVA Mule Barn/Restoration Shop drains directly to the exterior soil surface. APVA employees confirmed that paintbrushes were routinely cleaned in this sink. This area should be tested in case of demolition of the building or new construction in this area. Septic systems were identified at the Dale House and the Yearley House/Jamestown Rediscovery™ Center.

A small fenced area behind the NPS maintenance fire cache building contained sand piles and tar debris; petroleum odors were observed in the sand pile. NPS officials informed VHB that a drum filled with tar was found in the river by a Boy Scout troop. The NPS took responsibility for it and its contents. The drum was placed in this fenced area and had no lid so rainwater accumulated in the drum. Contaminated water and tar eventually spilled onto the ground. NPS informed VHB that the drum has since been properly disposed.

VHB performed a general walkover of the main parking and bus area for Jamestown Island. Stormwater drains from the parking area to a small, tidally influenced, open water pond located next to the bus parking area. VHB observed a sheen on the pond. VHB also noted that several buses were parked in the area with engines running throughout the day. Asphalt repaving and running vehicles could contribute to petroleum runoff into the pond.

Table 3-34: Jamestown Storage Tanks Inventory

| Location | Tanks Removed | Tanks Installed | Information Source | Comments (Records and Maps) |
|--|-------------------------|---------------------------|---|--|
| NPS/APVA Visitor Center | 8,000-gallon UST | | NPS file photos | Water encountered in excavation. |
| | | 8,000-gallon UST | NPS files, visual confirmation | |
| | 3,000-gallon UST (6/92) | | NPS file photos, Daily Log of Construction | Sewer line broke during excavation. |
| | | 5,000-gallon UST (11/91) | NPS file photos, Shipping Order | Tank Brand Sti-P3 tank. |
| Lift station 2-3 (NPS/APVA Visitor Center) | | UST | EDR Report | UST associated with James City County lift station located at rear of Visitor Center. |
| NPS Maintenance Facility | 1,000-gallon UST | | Daily Diary (10/5/95), FY 1996 Funding Memo, 1994 Funding Memo | Tank is 20-30 years old, replaced with fiberglass. |
| | Two USTs | | Observed remaining vent pipes, NPS official verbal confirmation | |
| | | 550-gallon AST | Daily Diary (10/4/95), visual confirmation | |
| NPS Maintenance Facility, building SN 125A | 250-gallon UST | | NPS file photos | |
| NPS Maintenance Facility, fire cache | | 1,000-gallon diesel UST | NPS officials, verbal confirmation, visual confirmation | Tank associated with fuel pump. |
| | | 2,000-gallon gasoline UST | NPS officials, verbal confirmation, visual confirmation | Tank associated with fuel pump. |
| | | Heating oil UST (1995) | NPS officials, verbal confirmation, visual confirmation | |
| NPS Maintenance Facility | 2 USTs of unknown size | | NPS files | |
| NPS ranger's quarters SN129 | 550-gallon UST | UST (10/95) | Daily Diary (10/6/95); FY 1996 Funding Memo; NPS file photos; visual confirmation | Tank is 20-30 years old. |
| APVA Yeardley House/ Jamestown Rediscovery™ Center | 1,200-gallon UST | | NPS files | |
| Harrington House | 500-gallon UST | | FY 1995 Funding Memo | Tank is 20-30 years old. |
| Former NPS archaeological lab | Fuel oil tank | | Post-1941 Topographic Map | Building has been removed; no documentation of tank removal; no visual evidence of tank. |
| Former NPS fire house/ tool house | | Gasoline tank and pump | Post-1941 Topographic Map | Tank and buildings removed in January 1941. |
| Former NPS quarters (located on James River east of former archaeological Lab) | Fuel oil tank | | Post-1941 Topographic Map | Building has been removed; no documentation of tank removal; no visual evidence of tank. |
| Former NPS tool and equipment storage (located east of "quarters") | Gasoline storage tank | | Post-1941 Topographic Map | Building has been removed; no documentation of tank removal; no visual evidence of tank. |

Notes: UST = Underground storage tank
AST = Aboveground storage tank

Old Pottery Studio

As part of the hazardous materials survey, VHB collected surficial soil samples at the location of the former pottery studio on APVA property. APVA officials informed VHB of the approximate location of the building. (The building was destroyed in a fire on January 12, 1988, and the ruins were bulldozed and disposed.) On May 16, 2001, surficial composite soil samples were collected from four sampling locations within the approximate former building limits. Each composite sample consisted of four discrete grab locations. The samples were collected from a depth of 0-6 inches. Soil samples were collected using a hand trowel that was decontaminated between each grab sampling location. The surficial soil samples were analyzed for total metals (arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver) by EPA Methods 6010B and 7471A (mercury only), PCBs by EPA Method 8082, and semi-volatile organic compounds (SVOCs) by EPA Method 8270C.

The documented field observations of the surficial soils and the laboratory analytical results support an acceptable level of risk for a conservative residential exposure scenario (Massachusetts Department of Environmental Protection S-1 risk-based standards). The metals detected are at concentrations that are typical of background soil conditions. The SVOCs detected are likely attributed to the residual burned building materials that also represent an acceptable level of risk to human health. Based on the above findings, no additional response actions are required nor warranted for the assessed surficial soils (0-6 inches).

Buried Munitions Site

On June 25, 2001, five members from a Naval Reserve unit in Fort Story, Virginia Beach, performed a site assessment at the far end of New Towne to locate Revolutionary and Civil War munitions. These munitions were buried there in 1975-76 by NPS staff and were not documented. Two retired and one currently employed staff

members who had witnessed the burial were able to roughly describe the deposited material.

The Naval Reserve unit swept an area roughly 0.25 acres in size with metal detectors. Two 12-foot-diameter sites were located. The material uncovered included: several hundred pieces of cannon fragments, several hundred solid metal shot of various sizes, and approximately 100 solid cannon balls of various sizes. None of the items contained gunpowder, and therefore were not considered hazardous. However, the soil was not tested at the time for possible lead contamination from the ordnance. All of the material collected was placed in the curatorial facility at Yorktown. The park's curator and archaeologist have documented and measured the site for record-keeping purposes. No other artifacts were uncovered during the removal.

3.3.3 Socioeconomic Resources

3.3.3.1 Land Use and Zoning

Setting at Jamestown Project Site

The Jamestown Project site includes Jamestown Island, Glasshouse Point, Neck of Land, and the adjacent portions of Colonial Parkway. The Sandy Bay bridge connects Jamestown Island to the mainland of James City County and additional land of Colonial National Historical Park. The Island is bordered by the James River to the east and south, The Thorofare water channel to the northeast, and Back River and Sandy Bay to the north.

The visitor's experience of Jamestown includes the arrival from the Colonial Parkway. Existing land use along the Parkway (from the midway point in Colonial Williamsburg to Jamestown Island) includes marsh areas and waterways, allowing the Parkway experience to maintain a park-like and natural character. The design of the Parkway itself enhances the visual character of the driving experience, allowing plenty of buffer along the road itself that effectively screens most adjacent land

uses. There are some areas, as the visitor gets closer to Jamestown Island, where new residential land use development can be seen through the trees. In addition, an area of agriculture/farmland use and a public marina (Jamestown Marina) are visible adjacent to the Colonial Parkway. The Jamestown Settlement, property owned by the Commonwealth of Virginia, is adjacent to NPS land and is also visible from the Parkway and from Glasshouse Point.

Specific land uses on the Island include: marshes, swamps, creeks, ponds, forests and woodlands, open-space grass fields, lawns, wetlands, a footbridge, vehicular bridges, unpaved roads, buildings on both the APVA and NPS properties, active archaeological sites, a small food concession building, and the NPS New Towne site with brick ruins, fencing, and open fields. There are also footpaths and the paved vehicular Loop Drive to the outer island. A parking lot, which accommodates 333 cars and 25 buses and large recreational vehicles (RVs) for the Visitor Center, is located at the northwest end of the Island. The APVA has a small parking lot at the Jamestown Rediscovery™ Center, as well as maintenance sheds for archaeological equipment. There are also numerous monuments and interpretive signs on the Island.

All of Jamestown Island is zoned R-8, Rural Residential District, by James City County (Figure 3-31). As defined in the *James City County Zoning Ordinance*, the Rural Residential District “is intended for application to rural areas of the county which remain inside the primary service area where utilities and urban services are planned but not yet fully available and where urban development may be expected in the near future. The district may also be applied to certain outlying areas where residences exist at similar densities or may be appropriate in view of housing needs. The district is intended to maintain a rural environment suitable for farming, forestry and low-density rural residence, together with certain recreational and public or semipublic and institutional uses, until

such time as an orderly expansion of urban development is appropriate.”

In addition, all of Jamestown Island, including Neck of Land and all of the Colonial Parkway, are designated Park, Public, or Semi-Public Open Space in the 1997 comprehensive plan. This designation is described as “large, undeveloped areas owned by institutions or the public and used for recreation or open space. These areas serve as buffers to historic sites, as educational resources, and as areas for public recreation and enjoyment.”

Jamestown Island, including Neck of Land and a portion of the Colonial Parkway, also fall into the designation of Community Character Area. James City County has designated certain towns and other locales in this way because of their historic nature, particular location, civic presence, or unique plan or design. The 1997 comprehensive plan recommends the area in and around Jamestown Island and Greensprings Road for a “high level of protection in order to preserve and enhance the integrity of the National Historic Site and its context, and maintain an appropriate setting and entrance for nearby historical areas.” Associated with this Community Character Area are specific development standards to protect its special qualities, including preservation of woodlands and open space, public access to the waterfront, pedestrian and bicycle circulation, and architecture and landscape compatible with the historic character of the area.

James City County and the City of Williamsburg

Land use categories in James City County include the following: Primary Service Area; Rural Lands; Low Density Residential; Moderate Density Residential; Neighborhood Commercial; Community Commercial; Limited Industry; General Industry; Mixed Use; Conservation Area; Park, Public, or Semi-Public Open Space; Federal, State, and County Land; Community Character Corridor; Community Character Area; Proposed Roads; and Enterprise Zones. Figure 3-31 depicts

the zoning of the Jamestown Project site and adjacent areas.

Residential Development

James City County has experienced rapid growth since 1970. The county's population has more than doubled since 1970 – growing from 17,900 in 1970 to 41,900 by the end of 1995. During that time, significant changes in land use were transforming the predominantly rural character of the county into a more urban and suburban environment. Construction of residential subdivisions continued in the established, more urban crescent around the City of Williamsburg. Residential subdivisions were also constructed in some rural portions of upper James City County.

In 1989, residential density regulations were revised to lower densities in the A-1 Agricultural zoning district. This revision slowed large-lot development in the rural areas of the county; however, since 1993, there has been an increase in the development of subdivisions in rural areas. Subdivisions have also increased along Jamestown Road (Route 31). Some of this residential land use adjacent to the Colonial Parkway is especially visible during the fall and winter, when deciduous trees have dropped their leaves. In particular, individual houses are visible on the northern side of the Parkway, immediately before Neck of Land.

Throughout the 1980s, expansion in established growth areas continued, and new development patterns also emerged. Established neighborhoods such as Kingsmill and Kingspoint continued to grow. Annexation by the City of Williamsburg transferred the majority of the county land encircled by Route 199 and much of the developed and vacant land in a narrow band along Strawberry Plains Road and portions of Richmond Road to the city. Due to the annexation and increased growth pressure, developments in the county pushed west and north.

The 1990s have also seen continued population growth. As in the 1980s, the majority of homes constructed between 1990 and 1995 were single-family units. A majority of the new homes have been built in the central part of the county along Route 5, Ironbound Road, Greensprings Road, Centerville Road, and Longhill Road. Much of the residential growth has occurred, and will continue to occur, in large planned communities located in this area. These planned communities, combined, will ultimately contain approximately 6,500 units. Stonehouse is another large planned community that will be constructed in the northern part of the county near the Barhamsville Road and I-64 interchange. Stonehouse is planned to contain approximately 4,400 residential units. Most of these planned communities have build-out periods from 10 to 20 years.

In 2002, the Planning Division of James City County hired a consulting firm to perform a Development Potential Analysis for the county's Primary Service Area (PSA). According to this study, the total development potential for the PSA is between 19,290 and 20,475 housing units. Based on recent growth rates, this would provide an adequate supply of housing lots for the next 20 years.

Citizen comments indicate widespread satisfaction with James City County as a place to live, with overwhelming agreement on the need to control growth. Hence, the James City County government considers that it has a clear mandate to manage the residential growth of the county while preserving its natural beauty, improving education, and maintaining basic services.

Business and Commercial Development

Jamestown Island is located on the York-James Peninsula, which is experiencing tremendous growth, mainly to the southeast in the Newport News area. Commercial, light industrial, and retail development is expanding in Newport News and many areas within James City County. In the City of Hampton, industrial growth is occurring in the

Hampton Roads Center area. Tourism, traditionally important to the regional economy, is also increasing steadily. The result is that the once predominantly rural character of the county has changed to suburban and urban.

Business and industry has been growing significantly since the 1970s. Development in the lower part of the county continued to diversify and intensify with the opening of Busch Gardens and the Busch Corporate Center. The Lightfoot area continued to develop with additional commercial growth along Richmond Road in the vicinity of the Williamsburg Pottery Factory. Retail space has doubled at the Pottery. During the 1980s, commercial growth in the Richmond Road area intensified with the development and expansion of numerous outlet-type retail shops, fast food restaurants, gas stations, and hotels from the City of Williamsburg line north to the Toano area. Commercial growth also intensified in the Five Forks area, and along Pocahontas Trail (Route 60) leading to Busch Gardens. Both commercial and office development continued at a rapid pace in the vicinity of the intersection of Jamestown Road and Route 199 and to a lesser extent near the intersection of Jamestown Road and Sandy Bay Road.

The 1990s have seen continued growth of the commercial and retail development along Richmond Road, Jamestown Road, and Ironbound Road. The county also saw the construction and expansion of several professional office centers. Such centers include Jamestown Professional Center, Busch Corporate Center, and Greensprings Commons Office Park. The county's first industrial shell building was constructed in the Stonehouse Commerce Park.

Farmlands and Forested Land

Approximately 50% of James City County is forested. Species composition is about two-thirds hardwood and one-third pine with a small amount of bald cypress. Age classes for the timber stands vary from one-year-old seedlings to mature pine stands and middle-age hardwood stands. The

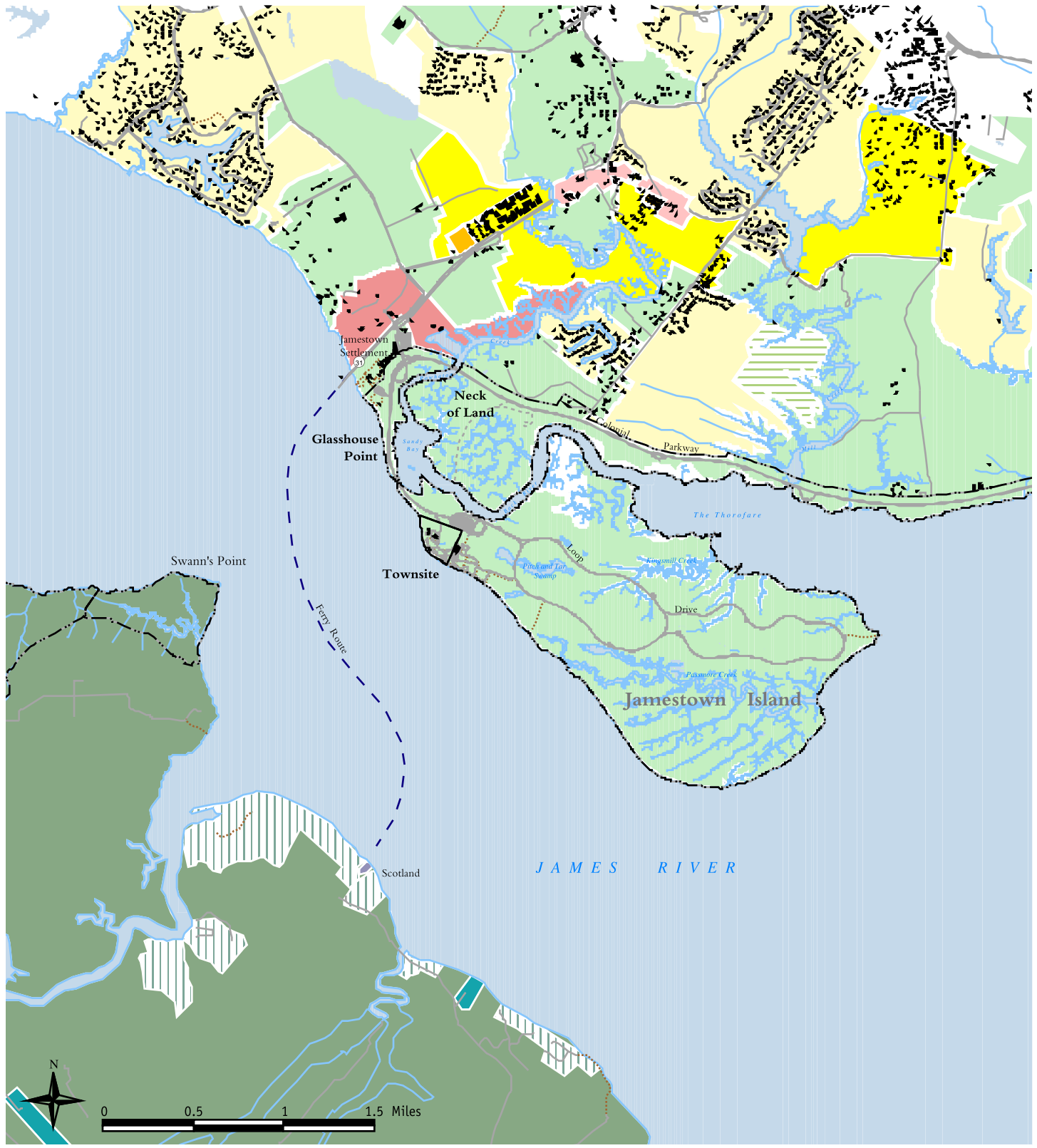
county's forests are the result of past land management practices; all of James City County has been cleared or farmed several times since 1607. In some cases, high-value stands have become established. In other areas, low-quality and low-value stands are normal. In the past 10 years, more than 2,000 acres have been established in commercial pine plantations. Most of these plantings have been made in the western end of the county and are being grown as an income-producing crop for the owner.

More than 50% of James City County is designated as rural land use. Rural Lands are areas containing farms, forests and scattered houses, exclusively outside of the Primary Service Area, where a lower level of public service delivery exists or where utilities and urban services do not exist and are not planned. Appropriate primary uses include agricultural and forestal activities, together with certain recreational and public or semi-public and institutional uses, which may require a spacious site and which are compatible with the natural and rural surroundings.

The Jamestown Project site, which includes Jamestown Island, has close to 50% of its land designated as forest. (Refer to the "Vegetation" section for specific mapping.) No farming presently occurs on Jamestown Island, though historically there has been farming on the Island since at least 1607.

Surry County

Surry County lies across the James River from Jamestown Island, and unencumbered viewsheds exist between the two areas. The county is therefore considered part of the context of Jamestown Island, as current land use and future changes and development there can affect Jamestown Island. The Jamestown-Scotland Ferry, which docks at the end of Jamestown Road (Route 31) near Jamestown Settlement, connects the James City County/ Williamsburg area with Surry County and other southern Virginia localities. The Virginia Department of Transportation operates the ferry at no charge to riders.



Legend

| | | | | | |
|--|--------------------------------|--|--|--|---|
| | A-1 - General Agriculture | | R-2 - General Residential | | B-1 - Local Business District (Surry) |
| | B-1 - General Business | | R-1 - Limited Residential | | R-2 - Vacation Residence (Surry) |
| | LB - Limited Business | | R-8 - Rural Residential | | HP - Historic Preservation District (Surry) |
| | R-5 - Multi-family Residential | | A-R - Agricultural/Rural Residential (Surry) | | |

Figure 3-31: James City County & Surry County Zoning

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The majority of Surry County is zoned A-R, Agricultural-Rural Residence District. Eighty-eight percent of the area along the shoreline of the James River, across from James City County and Jamestown Island, is zoned A-R. According to the Surry County Zoning Regulations (No Date), this designation encourages agriculture and forest uses, as well as preservation of the natural beauty in these rural areas. A-R allows for spacious residential development within rural areas; however, planned, large-scale subdivisions are controlled. In addition, a special review process is required for nonfarm construction in fields or pasturelands.

Three small areas across from Jamestown Island are zoned HP, Historic Preservation District. There are also three areas zoned R-2, Vacation Residence District, across from Island. This designation provides for moderately low-density vacation home development, generally along waterways. R-2 allows for a variety of housing types, including mobile homes, and since occupancy is primarily seasonal or intermittent, a somewhat more intense use of land is allowed. Development in the R-2 zones is visible from Jamestown Island. Such development is also near the Jamestown-Scotland Ferry landing on the Surry County side of the James River.

Around the ferry landing, the zoning classification is B-1, Local Business District. According to the Surry County Zoning Regulations (No Date), B-1 allows retail and personal service uses to serve local areas and/or highway travelers. Certain restrictions apply to structure size and signage. In addition, residential developments occur further into Surry County off of Route 31 and leading into the town of Surry. Figure 3-31 depicts the zoned areas visible from the Jamestown Project site.

Future land use in Surry County is likely to remain largely agricultural. Presently, the county has some industrial land use areas and the nuclear power plant (Surry Power Station). The county is very supportive of the conceptual plans for new facilities

at Chippokes Plantation State Park, which would generally provide more visitation and tourism dollars for the county. There are also trends in Surry County of new residential development associated with the waterfront and in close proximity to the Jamestown-Scotland Ferry and the town of Surry. Any development on the waterfront of the James River in this vicinity of Surry County would be visible from Jamestown Island.

Public Recreational Facilities and Use

As a whole, the three counties of James City, York, and Surry, and the City of Williamsburg, have many opportunities for recreation and outdoor activities. Other units of Colonial NHP, two state parks, five county parks, and four community parks are within 15 miles of Jamestown Island. More than 5,500 acres of parkland are represented. In addition, public boat access exists nearby, and two community centers provide recreational opportunities for residents of all ages. Williamsburg, York, and Surry also offer additional recreational opportunities that are available for shared use with James City County residents. Seven nearby school properties also provide recreation areas to the public, representing an additional 117 acres of neighborhood park facilities.

In addition to public facilities, James City County contains numerous private recreation facilities. These include the privately managed Busch Gardens theme park and its subsidiary Water Country USA, which offer family recreation and entertainment. Jamestown Settlement, adjacent to the NPS Jamestown property, offers sightseeing opportunities and access to the independently owned and operated Jamestown Explorer, which offers water tour rides around Jamestown Island.

Through its 1993 *Parks and Recreation Master Plan*, 1998 *Regional Bikeway Plan*, and 2001 *Greenway Master Plan*, James City County has recognized well-planned and -maintained parks and trails as essential for maintaining a high quality of life for its residents and has addressed the growing demand

for the county to provide additional recreational facilities. In spite of the many recreational facilities available in the region, the master plan noted a significant actual and projected deficit of larger regional parks from 50 to 200 acres, and certain types of recreational facilities such as biking, jogging and hiking trails. This deficit has placed tremendous pressure on existing park facilities, including Colonial NHP, for additional recreational use. James City County is attempting to meet the increasing recreational demands of a growing population by acquiring additional parklands and expanding existing recreational facilities or constructing new ones. Several new and expanded park facilities are now in place in the county. The 2001 *Greenway Master Plan* includes priority actions for trail development in 2002, 2003 through 2007, and 2008 through 2012.

The major public parks located near the Jamestown Project site offer recreational activities that would complement the interpretive activities at Jamestown Island. In addition, many of these parks interpret resources that are thematically related to those of Jamestown. Visitors to York River State Park and Chippokes Plantation State Park can learn more about Tidewater Virginia history and ecology as well as use a variety of recreational facilities for canoe trips, hiking, horseback riding, picnicking, fishing, boating and volleyball. Chippokes Plantation State Park, in Surry County, recently completed a new master plan that relates new facilities, activities, and waterborne transportation to Jamestown Island. Visitors to Jamestown can bicycle along the Colonial Parkway, which provides glimpses of Tidewater Virginia's abundant natural beauty. Roads and trails in the park provide for hiking, bicycling, jogging, and sightseeing, and allow public access to the waterfront for fishing and birdwatching. A variety of facilities and programs at Yorktown and Jamestown interpret the history of the area.

The county's District Park, just north of the Green Spring historic site, has historical significance as the site of one of the first freed-slave communities in

Virginia, and may house a historical educational center in the future. The county's District Park Sports Complex, currently under construction, is located north of Jamestown. This park will feature major recreational facilities: a five-field baseball complex, a four-field softball complex, and a nine-field soccer complex. In addition to playground and picnic areas, a network of bike paths and walking trails will encircle the complex. Other county parks with major recreational facilities located near Jamestown include Little Creek Reservoir Park, Mid-County Park, and Upper County Park.

James City County is the centerpiece of a unique historical area, famous around the world, because it encompasses land important in the early years of our nation: Jamestown, site of the first permanent English-speaking settlement in 1607; Williamsburg, the restored colonial capital of Virginia between 1699 and 1780; and Yorktown, the final battle field of the Revolutionary War in 1781. The three jurisdictions – James City County, York County, and the City of Williamsburg – have an obligation to collaborate on policies and programs, infrastructure, and land use to preserve this Historic Triangle.

3.3.3.2 Demographics and Income

Given its location in the Hampton Roads metropolitan area, and its proximity to rural localities south of the James River, the affected environment at Jamestown includes a diverse demographic base. Affected localities include James City County (immediately surrounding Jamestown) and Surry County (directly across the James River and connected to James City County by ferry). The demographic and income profiles of the two counties differ substantially.

James City County

James City County has experienced significant population growth since 1970, and the growth trend is expected to continue into the foreseeable future. From a population of roughly 17,900 in 1970, the county has grown to 48,102 according to year 2000 Census data. The highest period of growth occurred between 1985 and 1990, when the county's

population increased by nearly 30%. Although growth rates have slowed somewhat, the population increased by 15% between 1995 and 2000, for an average annual increase of 3%. Projections made by county planning staff suggest that this trend will continue, and that by 2010 the county will be home to nearly 68,000 people. The majority of this growth is the result of in-migration; the number of people moving to James City County exceeds the number moving out.

Trends indicate a shift toward an older, less racially diverse population in the county. Between 1970 and 1990, middle-aged persons and retirees increased as proportions of the population, and between 1980 and 1990, the median age increased from 30.8 to 33.7. From 1970 to 1990, the nonwhite population decreased from 35% to 20%; this trend continued during the 1990s, and the county's nonwhite population fell to 18% by the time of the 2000 Census.

Along with population, per capita income in James City County has increased significantly in recent years, rising by 91% between 1983 and 1993. The 1993 figure of \$22,383 was higher than the state's and was the highest of any locality on the Peninsula. Year 2000 Census data estimate median household income at \$51,424, higher than the state median of \$40,209.

Surry County

Surry County has also grown since 1970, although at a much slower rate than James City County. From a population of 5,882 in 1970, the county has grown to 6,484, according to year 2000 Census data. Projections made by the Weldon Cooper Center for Public Service at the University of Virginia suggest that this slow growth trend will increase slightly, and that by 2010 the county will be home to nearly 7,095 people.

Surry County also has a different racial makeup than James City County. According to the 2000 Census, the nonwhite population in Surry accounted for 53% of the total. From 1970 to 1990,

the proportion of the nonwhite population decreased from 65% to 56%. However, trends in Surry, like those in James City, indicate a shift toward an older population.

Also as with James City, median household income in Surry has increased since 1990. Unlike James City, however, the Surry figure is lower than the state's. The 2000 Census estimates \$31,097 for median household income, up from \$25,027 for 1990.

3.3.3.3 Regional and Local Economy

The government, military, and service sectors dominate the Hampton Roads economy. Tourism, manufacturing, and port-based activities also play strong regional roles. The deepwater port that serves the region is one of the East Coast's largest facilities, and the Virginia Port Authority website cites early water-based commerce at Jamestown as the precursor for today's thriving harbor. As with their demographic profiles, the economies of the two affected localities differ significantly.

James City County

Two industries dominate the county's economy: tourism and beer. Attractions such as Jamestown, Colonial Williamsburg, Busch Gardens, and Water Country USA attract visitors from around the world. The Anheuser-Busch Brewery is a primary employer, and in 1996 began a \$100 million expansion. Agricultural employment in James City and Williamsburg fell from 191 in 1970 to 70 in 1999 – less than 1% of total employment. Employment from government and government enterprises remains a significant part of the employment picture, although it has decreased as a proportion of the total since 1970. As of 1999, government-related employment was 8,647 – 18% of the total full- and part-time employment of 47,974 (these data are combined for James City and Williamsburg).

To diversify its economic base, James City County actively pursues development of high-skilled employment provided by environmentally sensitive industries. Recent success in the form of

development at the Stonehouse Commerce Park suggests that diversification may continue, although these ventures remain a relatively small part of the county's economy. In 1996 a State Enterprise Zone was designated in the southern section of the county.

Economic trends in James City County suggest continuing economic vitality. Between 1980 and 1995, unemployment fell from 5.2% to 2.8% – lower than the state and the region. From 1990 to 1995, employment in the county increased 19%, also higher than the state and the region. During the same period, retail sales increased by 37%, totaling \$449.8 million in 1995. Census 2000 data, however, cite retail sales of \$303.8 million for 1997.

The rapid pace of residential growth in James City continues to strain public expenditures. At \$0.87 per \$100, the county's real estate tax rate has increased only 2.4% since 1980. At \$4 per \$100, the personal property tax rate has not changed since 1980. Despite steady revenue increases since 1986, population growth and resulting capital facilities construction have brought rapidly increasing debt service.

As stated above, tourism is a major component of the economy. According to the Virginia Tourism Corporation, traveler spending in James City County was \$247 million in 1999, down from \$252 million in 1998. Visitors to Jamestown contribute to this sector of the economy, and in 1999 visits to the Jamestown Visitor Center totaled 331,880 – up 2.2% from 1998.

Surry County

Agriculture is a significant part of the economy in Surry County, and in 1970, it accounted for 19% of the county's employment. Between 1970 and 1990, however, farm employment decreased from 686 to 204, before increasing slightly to 223 in 1999. This represents roughly 8% of the total employment in 1999.

Employment from government and government enterprise is also significant in the county. Between 1970 and 1999, employment in this sector increased

from 292 to 493 – 19% of the total full- and part-time employment of 2,631. Total employment in Surry fell between 1970 and 1999, from 3,662 to 2,631.

The 2000 Census states that 1997 retail sales in Surry County totaled \$8.9 million, up from \$6.4 million in 1992, as cited in the *1992 Economic Census: Census of Retail Trade* (U.S. Census Bureau).

Tourism is not as significant in Surry as in James City, and the Virginia Tourism Corporation indicates that traveler spending in Surry was \$7.2 million in 1999, up slightly from 1998.

Cooperating Agreements and Related Services

Eastern National and NPS

Eastern National is a nonprofit group that has a Cooperating Association Agreement with the National Park Service and with Colonial NHP. Cooperating associations are private, nonprofit corporations established under state law. They support the educational, scientific, historical, and interpretive activities of the NPS in a variety of ways. At the Glasshouse, Eastern National manages both the production and sales end of the glassmaking demonstration. Profits from this operation are sent to a central account of all the various park sales, and 6% of the proceeds are returned to the park as a donation. The three Eastern National operations at Colonial NHP (Yorktown, Jamestown, and the Glasshouse), combined, are the third-highest income producer within parks where Eastern National operates. In 2000 these three operations reaped more than \$1.5 million in sales, and their donation return to the park was \$80,000 to \$90,000, which funded special interpretive and research programs at Jamestown and Yorktown. This donation is a critical component of the interpretive budget each year. As detailed below, the APVA also receives Eastern National money from the Jamestown Visitor Center operation, but not from the Glasshouse or Yorktown.

Director's Order 32 describes the policy and procedural requirements for relationships between the NPS and cooperating associations. It is intended to help ensure the success of the relationship between the National Park Service and Associations by specifying operational policies and procedural requirements governing their relationship.

The overall NPS *Management Policies 2001* (2000d) serve as the basic foundation for *Director's Order 32* and the *Cooperating Association Reference Manual*. Issued by the associate director of park operations and education, this manual provides a comprehensive compilation of the procedures, practices, and requirements applicable to the National Park Service's relationship with associations.

Legal code 16 U.S.C. Sec. 1-3, 6, 17j-2(e) is the binding authority over these guidelines.

Eastern National and APVA

As a part of the memorandum of agreement (first signed in 1956) with the NPS, the APVA was given the right to operate a museum shop and post office in the Jamestown Visitor Center. The APVA independently operated the shop from 1957 through 1983. In 1983, the APVA, with NPS approval, entered into a sublicensing agreement with Eastern National for the museum store operations. From 1983 to 98, Eastern National paid the APVA a flat rate for the lease of the concession, and Colonial NHP received the normal "percentage donation" from Eastern National. The effect was that APVA and the park received approximately the same amount from the "profits" of the Eastern National museum shop. The NPS pays for heat and air, janitorial services, lights, trash collection, photocopying, and overall maintenance of the building. The principle of sharing gift shop proceeds was reaffirmed in the APVA/NPS Agreement (the Cosmos Treaty) of September 1999.

In 1999, a new format for the agreement between APVA and Eastern National was negotiated. In addition to the flat rate, APVA receives 50% of net

proceeds minus the base rent for the applicable accounting period. This structure allows the National Park Service and the APVA to participate in the success of the Jamestown museum shop. The APVA, along with NPS, has taken a more active role in reviewing products and publications, suggesting and developing additional products, and working with the Eastern National staff. Eastern National has also offered assistance to the APVA with product distribution, placement of products on its website and funding for reprinting publications.

Legal Agreement with the Carrot Tree Bakery

The need for refreshments on Jamestown Island has long been recognized. Because lunch facilities have not been available in the past, visitors have cut the duration of their visits. As a way to gauge the need and ultimate success of a food service operation, in 2000 the APVA began discussions with the owners of the Carrot Tree Bakery to provide light lunches and refreshment near the Dale House. In accordance with the Memorandum of Agreement, the APVA sought the consent of the National Park Service, through the superintendent of Colonial NHP, to begin this service.

The Carrot Tree began its operations in April 2001. By every account, the business venture is a success. Operating from a temporary facility under a letter of contract with the APVA, the Carrot Tree offers a variety of sandwiches, drinks, soups, and salads on a daily basis from 10 a.m. to 5 p.m. The contract is seasonal (April 1 through October 31) and carries a three-year renewal option. It also specifies a base rent and a percentage of sales of gross sales over \$16,000. The APVA plans to share with NPS a percentage of the profits once all associated start-up and administrative service fees have been cleared.

The Carrot Tree's main operation is located on Jamestown Road and is open daily. The facility serves a greater variety of baked goods, sandwiches, soups, salads, and pre-prepared hot entrees, as well as beverages.

Jamestown Explorer

The Jamestown Explorer is a privately owned boat service that provides 1-hour narrated nature and history tours of Powhatan Creek, Back River, and Jamestown Island. In June through August, five tours are offered daily, leaving from the Jamestown Marina. In addition, sunset tours run on Wednesday and Saturday evenings at 7 pm, and “Haunted Night Tours” are given several times per week. The Jamestown Explorer estimates that 16,000 to 20,000 people take tours each year at a cost of \$10 for adults and \$5 for children, ages 8 to 15. There is no charge for children under 8 (Jamestown Explorer 2002).

The *Jamestown Long Range Interpretive Plan* (Colonial NHP 2000b) identifies the river’s historic importance. Therefore, in 2002 the NPS will provide a joint interpretive program through a general agreement with the owner of the Jamestown Explorer. Rangers will be on the tour boats from June 15 through August 18. This will also provide general data useful in the development of boat tour operations as part of the visitor experience proposed in this DCP/EIS.

3.3.3.4 Emergency Services

Emergency services for Jamestown Island and the surrounding areas are provided by a number of sources. The NPS employs law enforcement park rangers, whose duties are discussed in the “Operations” section of this document. Agreements with local and state police provide additional law enforcement coverage. James City County’s emergency service facilities are discussed below.

James City County operates five fire stations, including a new facilities in the vicinity of Green Spring and on Monticello Extension. In addition, the James City/Bruton Volunteer Fire Department provides service. The county also has a fire training facility at Eastern State Hospital. Local police service is provided through the law enforcement center on John Tyler Highway and a central dispatch in Toano. Williamsburg Community Hospital provides emergency medical service.

3.4 RESEARCH AND EDUCATIONAL PROGRAMS

3.4.1 Existing Research – APVA

With the University of Virginia, the APVA has since 1994 sponsored the Jamestown Rediscovery™ Archaeological Field School, designed to teach the methods and theories of fieldwork in American historical archaeology. The fieldwork concentrates on excavation of areas of the 1607 James Fort Site and the expanding town outside the palisade. The school offers participants an opportunity to learn the practical skills of excavation and recording, including detailed instruction in the use of archaeological tools, ranging from the trowel to the laser transit. This resource is another important way the APVA shares the moment of discovery with the public and education students at the same time.

In addition, the APVA maintains and manages a collection of artifacts, archival documents, and photographs. Scholars and students access the collection by various means, including study on site and the Internet. With increasing awareness of the findings of Jamestown Rediscovery™, the requests for information have grown phenomenally.

3.4.2 Existing Research – NPS

The NPS manages the Jamestown collection, which includes 650,000 artifacts, paintings, archival documents, and photographs. The collection, which averages 15 to 30 inquiries per month, is accessed primarily by scholars, students, contractors, and park staff. These groups use the collection for research on park resources, comparative analysis, and interpretive presentations and exhibits. Current projects include doctoral research on the Jamestown artisans and a comparative analysis of the material discovered at Green Spring with that at Jamestown.

In addition, the NPS conducts research as identified in the park’s *Resource Management Plan* (Colonial

NHP 1999) and *Jamestown Long Range Interpretive Plan* (Colonial NHP 2000b). The projects focus on identifying and evaluating the significance of the park resources. Recent projects include an African-American study for Jamestown and Green Spring; the *Jamestown Cultural Landscape Report* (OCULUS 2002), which is currently underway; and archaeological field investigations east of New Towne along the Jamestown shoreline and at the Jamestown parking lot. Additional research efforts will focus on questions raised during the Jamestown Archeological Assessment project and an American Indian study, once funding is made available.

NPS funding and staffing for natural resource monitoring are limited. The state conducts an annual eagle survey, and an invasive species monitoring program was begun in 2001 to assess recent mitigation activities. Also, seagull behavior research occurs on the isthmus; no NPS funding is involved with this activity.

3.4.3 Existing Education Programs – APVA

The APVA sponsors a variety of education programs, many with the NPS. In addition, interpretive tours (discussed in a subsequent section of this report) are part of the overall learning experience.

Each October, in celebration of Virginia Archaeology Month, the APVA and the NPS co-sponsor a children's education program. In 2000 about 65 children participated in this daylong program. Also in October of each year, the APVA sponsors a Lecture Series focusing on aspects of early colonial American history as they relate to Jamestown. Each year, approximately 600 people attend the series of three lectures. Other recurring activities include approximately 12 Jamestown Rediscovery™ outreach programs per year by APVA volunteers at schools and community group meetings. In 2000 and early 2001, the APVA and the NPS also jointly sponsored educational activities in

connection with American Indian Month (November), African-American History Month (February), and Jamestown Day (May). Activities during American Indian Month included a special exhibit on English-American Indian trade, as well as demonstrations of American Indian crafts such as flint-knapping and basket making. During African-American History Month, a guest speaker presented a lecture on the significant contribution of Africans to the success of colonial Virginia. Jamestown Day, for the past two years, has featured special living history programs, archaeology tours, activities geared to families and children, and special exhibits.

These programs are continually evolving and expanding. As 2007 approaches, more education programs jointly sponsored by the APVA and the NPS are expected.

3.4.4 Existing Education Programs – NPS

The NPS education programs are targeted mainly toward schoolteachers and students, and have been conducted at Jamestown and Yorktown since the early 1970s. Educational outreach at Jamestown includes five curriculum-based programs that meet the Virginia Standards of Learning. During the 2000-01 school year, 202 programs were offered at Jamestown, serving 10,095 students from across the country. The programs include: Jamestown, A Beginning; Virginia Indians; Jamestown Archeology; Mysteries of the Past; and specialized Walking Tours.

Currently, an Education Needs Assessment is being prepared for the park's education programs. Area teachers have met with the park and APVA staff to evaluate the current programs and recommend improvements to meet the needs of the teachers and students. The report will be available for implementation in FY 2002. One of the recommendations includes joint sponsorship by the Jamestown-Yorktown Foundation and Colonial

Williamsburg Foundation of a Teacher's Institute on colonial history.

Through cooperative agreements with the Colonial Williamsburg Foundation and the College of William and Mary, the NPS also sponsored numerous field schools as part of the *Jamestown Archeological Assessment*. The first Green Spring field school was held from the fall of 2001 through the spring of 2002.

3.5 VISITOR EXPERIENCE

3.5.1 Regional Visitor Experience

Colonial NHP plays a critical role in the regional tourism framework. Along with Colonial Williamsburg, Jamestown and Yorktown complete the Historic Triangle that drives history-based tourism on Virginia's Peninsula. The uniqueness of Colonial NHP lies in the concept of explaining the beginnings of the development of the United States of America. Jamestown, founded in 1607, was the site of the first permanent English settlement in North America, and Yorktown was the scene of the last major battle of the American Revolution in 1781. Not only do the two sites mark the beginning and end of English colonial rule in America, but they also interpret the development of the political ideology of a people that culminated in the Declaration of Independence and the Constitution, precedents for establishing future governments in the world. The two sites also interpret the economic and social aspects of the British colonial experience.

The connections between Jamestown, Green Spring, Colonial Williamsburg, and Yorktown are presented to the public through interpretive media, presentations, lecture series, and special events and programs. The annual program which links the Bacon's Rebellion's impact on Jamestown and Green Spring is just one example of the joint programs currently presented at Jamestown. In addition, the Colonial Williamsburg Foundation

works with both the NPS and APVA on providing tours of both Jamestown and Yorktown to special groups, including the annual Teacher's Institute.

The restoration of the colonial section of Williamsburg occurred in tandem with the development of the park so that by 1957, both the park and Colonial Williamsburg became major historical destination points in the region. The additions of the Jamestown-Yorktown Foundation living history museum facilities depicting colonial life at Yorktown and Jamestown enhanced visitation options. The area became a catalyst for recreational opportunities, which resulted in the development of cultural and recreational attractions.

The Williamsburg Area Convention & Visitors Bureau, the Jamestown-Yorktown Foundation, and the Colonial Williamsburg Foundation heavily market the major historical destination points in conjunction with two of the area's primary theme parks, Busch Gardens and Water Country USA. The theme parks and Colonial Williamsburg dominate the public's perception of area attractions and accounted for more than three million visitors in 1998. Units of Colonial NHP are also important attractions, but there has not been a joint ticketing option to include the federal historic sites in the joint pass, despite APVA and NPS efforts. It is hoped that ongoing discussions will allow the park to offer a joint ticket option with Colonial Williamsburg and the Jamestown-Yorktown Foundation, highlighting the historic sites. In 2001, the Jamestown-Yorktown Foundation and the NPS jointly sponsored a symposium on Military Leadership in Virginia during the American Revolution, which included a bus tour linking the Revolutionary War events at Jamestown, Green Spring, the Williamsburg area, and Yorktown. The success of this event is promising for similar joint programs in the future.

The Greater Peninsula region, in which the park is located, is a destination point for many visitors who seek recreational and educational experiences. In addition, Virginia Beach, a major destination point for beach- and marine-oriented vacationers, lies to the south of the Peninsula. The broader Hampton Roads area (which encompasses the Peninsula and Southside) has a fine selection of art, military, and technology museums, concert halls, and many seasonal festivals that enhance the visitor's stay in the area. The primary vehicular route through the Peninsula and into Southside Hampton Roads is Interstate 64, passing by Williamsburg and over the Colonial Parkway with exit points to both areas.

3.5.2 Jamestown Visitor Experience

3.5.2.1 Interpretive Themes

The NPS and APVA work together to offer a variety of programs that contribute to visitor understanding of Jamestown. In 2000, they completed the *Jamestown Long-Range Interpretive Plan* (LRIP). The LRIP addressed the challenge in presenting a holistic Jamestown by incorporating the recent archaeological findings and documentary research in all areas of interpretive operations in a systematic way to create a seamless experience for visitors. It emphasized the need to promote the "One Jamestown" concept to alleviate visitor confusion and provide a more complete visitor experience. It also considered the opportunity presented by the upcoming 400th anniversary of Jamestown to develop new interpretive media and relate the findings throughout the visitor experience. The LRIP addressed successes and failures in the existing interpretive programs and media in meeting goals set forward in *The Road Ahead: A Plan for Achieving Excellence in Education and Interpretation* (NPS 1997b) and the park's *Strategic Plan*. The LRIP identified the interpretive themes for Jamestown and the Park (Table 3-35).

3.5.2.2 Visitor Orientation

Pre-visit

The APVA and NPS maintain information programs designed to provide pre-visit orientation to a wide a variety of individuals. However, persisting confusion between the Settlement and the Island, combined with the apparent lack of understanding of significance, seems to indicate that these programs are not effective. Both organizations have websites that link to *Jamestown 2007*, a Web site which describes the development of programs and activities for the commemoration. The Commonwealth of Virginia, National Park Service, and the APVA jointly sponsor the link, and plans are being developed to improve this service. The NPS website provides directions by plane, car, and mass transit. It also provides local weather and nearby attraction links, and describes major planned events at the park. Nevertheless, the JLRIP notes that it is difficult to access information about Jamestown Island directly from the website, as users must follow links to other sites.

Additionally, the National Park Service and APVA are members of the Williamsburg Area Convention & Visitors Bureau, which actively directs incoming visitors to Jamestown. The bureau's annual visitor's guide includes a two-page spread highlighting Jamestown.

Pre-visit information is also included in publications such as *The Virginia Travel Guide* and the *Williamsburg Visitor's Guide*. Brochures are also distributed to the many hotels in the Williamsburg/James City County area and the Colonial Williamsburg Visitor Center. Visitors also frequently call or write the park before their visits to ask for maps and other orientation materials. Finally, familiarization tours are given periodically to tour guides from across the country as a way of encouraging visitation to Jamestown Island.

Table 3-35: Jamestown Long-Range Interpretive Plan Themes

| Primary Themes | Description |
|-------------------------------|---|
| Parkwide: | |
| 1. | This history and resources of Jamestown, Green Spring, Williamsburg, and Yorktown represent the cultural, military, political, social, economic, and diplomatic forces that changed English, other Europeans, Africans, and First Americans, in the thirteen colonies, into citizens of an independent United States. |
| 2. | The resources of Jamestown, Williamsburg, and Yorktown were the subjects of some of the earliest national preservation efforts. |
| Jamestown (Primary): | |
| 1. | As the first permanent English settlement in North America, Jamestown and its people experienced many changes and adaptations often through experimentation that left a legacy of laws, language, and customs that were beneficial as well as tragic, depending upon one's race. |
| 2. | Jamestown's people—native, immigrant, and enslaved—reflected diverse national and cultural traditions that influenced the emerging New World society. |
| 3. | Jamestown experienced significant periods of development and decline as it physically and functionally evolved. |
| Jamestown (Secondary): | |
| 1. | The history of Jamestown reflects the many different ways that humans have interacted with the natural world. |
| 2. | Jamestown, located on the James River, possessed strategic value during military conflicts from the 17 th to 19 th centuries. |
| 3. | During the 20 th century, some of the most innovative methods and applications of the science of historical archaeology were developed and applied in the exploring and rediscovery of 17 th century Jamestown. |

On-site Orientation / Visitor Contact

Lack of distinction between the “two Jamestowns” hinders on-site orientation, and can create a frustrating first impression for visitors. Although the NPS has posted signs on the Parkway directing visitors to the “three ships” or the “original fort site,” anecdotal evidence suggests that visitors do not understand the difference. NPS staff at the entrance booths, as well as staff at the Settlement, continue to report significant numbers of visitors who are unclear about where they are going.

From the entrance booths, NPS staff direct visitors to begin their tour at the Visitor Center (built in 1956 and remodeled in 1976), where they have direct contact with park personnel and can receive maps, brochures, and programming information. The Visitor Center functions as the main point of orientation and offers a variety of information sources, including the *Welcome to Jamestown* brochure developed jointly by the NPS and APVA and funded through a grant from James City County. At the center, visitors have the opportunity to view alternating 15-minute films on Jamestown (the original NPS, 1956 watercolor-image

presentation that was updated in 2000 and a new film completed by the APVA). The exhibit area, completed in 1976, contains a limited number of archaeological objects in triangular cases with little text and sparse information relating to the history and significance of Jamestown. Few of the exhibits focus on the primary themes or address the role of Africans/African-Americans and American Indians in the development of Jamestown and Virginia. The exhibits include Mission 66 era paintings by Sidney King and a now inaccurate model of the fort. The museum bookstore includes a large selection of books on colonial history and teacher education guides, as well as videos, reproduction Jamestown pottery, original Pamunkey pottery, reproductions of artifacts recovered at Jamestown, and replica colonial toys.

From the Visitor Center, tourists have the option of following a self-guided tour through the New Towne (the Townsite), or taking a guided tour highlighting life on Jamestown Island in the 17th century. APVA explorations of the original fort and later period buildings are featured on the tour. In addition, two APVA volunteers work as greeters and circulate around the church in an effort to provide general information and answer questions. The greeters provide excellent on-site orientation, but staffing limitations restrict the scope of this outreach, especially during the peak season.

Presently, trained volunteer interpreters are stationed at active excavation sites on the APVA property and in the Dale House, the archaeological laboratory. In 2000 these interpreters interacted directly with approximately 202,330 visitors. In addition, a core group of APVA volunteers gives tours of the APVA Jamestown Rediscovery™ archaeological project year-round, catering to approximately 2,200 people in 2000. Schoolchildren, from Virginia and other states, accounted for roughly 75% of the participants, while elderhostel groups, conferees, and “lifelong” learners accounted for the remainder. The site coordinator organizes tours in cooperation with teachers and

group leaders who request guided tours of the excavation site. A reasonable fee is charged for these tours. The tours generally last 90 minutes and include a visit to the Jamestown Rediscovery™ excavation site, the church, the artifact lab/gallery, and other points of interest on the APVA property. Beginning in January 2001, group leaders have been asked to complete evaluations of the tours so that APVA can document their feedback and make adjustments to meet the needs of each group. Tours are also offered at the 1649 Church Tower and reconstructed Memorial Church from April through October. Guides share information related to the importance of religion in the early colony and the place of the church in the community.

Throughout the year, NPS staff conduct tours and programs focusing on the park's themes and highlighting special events. In FY2001 (October 2000 to September 2001), 319,609 visitors toured the Visitor Center. During the summer, NPS interpretive tours and programs are offered daily every 30 minutes from 9:45 a.m. until 4:15 p.m. From September to November, dependent upon staff availability, four Park Ranger tours offered daily, with Living History tours offered on weekends. During the winter, two tours are offered per day. From March until June, four Park Ranger tours are offered each day, depending on the availability of staff and number of education programs scheduled. During FY2001, 60,635 visitors participated in Park Ranger tours of the church, fort, and threshold to New Towne, as well as special tours focusing on New Towne archaeology. The tours focus on the primary story of Jamestown with special emphasis on various aspects of the story dependent upon the person giving the tour. Some of the aspects covered include the African American story, the American Indian perspective, and the role of archaeology in telling the Jamestown story.

During the summer, the Park Ranger tours alternate with Living History tours conducted by contract players who portray various individuals

from Jamestown's 17th century past, including John Rolfe, Mrs. Joan Peirce, and Mistress Elizabeth Bacon. The tours average 80 to 150 people per tour, but can host as many as 200. Due to budget limitations, the Living History tours are suspended from winter until spring. In FY2001, 30,499 visitors attended the Living History tours. In addition, the Pinch Pot program (a hands-on program for children) is offered at least twice a day during the summer, and 8,764 children participated in this program in FY2001.

Special programs and events are highlighted throughout the year to emphasize specific events and themes, including African-American History Month, Women's History Month, the Founding of Jamestown, Historic Preservation Month, First Assembly Day, Virginia Archaeology Month, Bacon's Rebellion, and American Indian Month. The NPS and APVA staff work together on these events and programs, providing special lectures, hands-on activities for children, temporary exhibits, and special tours.

Although primary orientation occurs at the Visitor Center, the Glasshouse is the first site visitors pass after entering Jamestown. A very popular stop, its location may hinder visitor orientation. Accessed from the Parkway into a parking lot, the site lies at the end of a short trail. The original Glasshouse site, found in the 1950s, is interpreted, and an adjacent 17th century, reproduction glassmaking operation exists just beyond the original site. Managed by Eastern National, visitors are able to purchase unique hand-blown glass items, including reproductions of 17th century items.

Another group of visitors with increasing numbers is local residents who enjoy the passive recreational opportunities offered at Jamestown, specifically walking, biking, and bird watching. Nearly 400 annual Jamestown and parkwide passes were purchased in FY2000 (in FY2001 the Island Loop Drive was closed due to repairs and repaving for nearly one year, resulting in a drop in the sale of

passes). The Island Loop Drive provides visitors, from local and distant areas, a pleasant experience that accentuates the natural beauty of Jamestown Island while waysides relate its historical and natural past. While many of these visitors do not enter the Visitor Center, they do attend the many special events and programs offered throughout the year and visit on a regular basis.

At present, the associated historic site of Green Spring, home of Sir William Berkeley, the 17th century Virginia governor who served from 1642 to 1677, is closed to the public, except for specially requested tours. A General Management Plan/EIS currently under public review includes plans to open the site in the near future. The intention is to link the history of Green Spring with the events at Jamestown Island and to expand the story of the early government of Jamestown through interpretive media, programs, and formal presentations. Visitors would be oriented to Green Spring at the Jamestown Visitor Center and then would be directed to the site. Special tours and programs offered at both sites would emphasize the connection between the capital of Virginia and the seat of the Royal Governor. Shuttle buses leaving from the Jamestown Visitor Center parking lot and taking groups to Green Spring are being considered. Educational programs emphasizing both the natural and cultural resources at Green Spring would also be developed.

3.5.3 Visitor Understanding of Significance

Quantifying the extent to which visitors understand the significance of Jamestown is a difficult task. Efforts to date suggest that visitor confusion between Jamestown Settlement and Jamestown Island may contribute to a lack of understanding. In a 1997 visitor survey conducted by the APVA, 3% of the 200 respondents suggested that confusion between the two sites was a problem. This percentage may seem low, but it warrants noting that these concerns were offered as general

comments – the survey did not contain a question relating directly to this issue. Furthermore, anecdotal evidence suggests that interpreters and park officials receive regular questions on this subject. Finally, in the most recent annual NPS survey of visitors to Jamestown and Yorktown (2001 Colonial National Historical Park Visitor Survey Report Card data, the Government Performance Results Act survey), only 72% understood the significance of the two sites, although 97% were satisfied with the overall experience. This suggests that although visitors enjoy the park, enhancements should be made to make the experience more informative and reach the National Park Service goal of 82%.

It should be noted that APVA volunteer interpreters are trained to convey to all visitors specific information about the significance of Jamestown. At a minimum, the interpreters explain to each visitor with whom they interact the relationship of where they are standing to the 1607 James Fort.

3.5.4 Carrying Capacity of Programs and Sites

The primary carrying capacity issue at Jamestown involves the size of guided tours. Both the APVA and the National Park Service prefer tours smaller than 30 people. Both organizations believe that groups of this size can experience the tour more fully than can larger groups. Nevertheless, current demand combined with staffing limitations makes this target a difficult one to maintain during the peak summer period.

APVA limits the size of the Jamestown Rediscovery™ tours given by the volunteer interpreters to 30 people. (The APVA has found that, especially with children, having groups of more than 30 people diminishes the effectiveness of the tours considerably.) To limit the size, larger groups are routinely divided into subgroups with interpreters assigned to each. Each guide is

instructed to follow a specific itinerary so that two guides are never in the same place at the same time. The number, interest, and skill levels of current volunteer staff limit the APVA to a maximum of two tours per day, depending on group size. When large groups are involved, only one tour per day is conducted. Staffing constraints therefore limit the ability to meet public demand.

On special event days such as Jamestown Day, and for other such educational programs offered throughout the year, volunteer interpreters give guided tours of the Jamestown Rediscovery™ archaeological site to the general visiting public. Since they are open to all visitors and offered only two or three times during the day, these tours are not limited in size. However, their effectiveness is compromised if the numbers become too large.

Although the majority of NPS tours range in size from 80 to 150 during the summer, the preferred group size is 30. A smaller group greatly enhances the visitor experience and increases the staff's ability to protect park resources. At current staffing levels (including Living History staff, interns and seasonal park guides), the NPS can conduct up to 14 tours a day during the summer, depending on staff availability and weather. Fewer tours are offered at other times of the year.

3.5.5 Amenities

Site amenities at the Jamestown Project site are limited, but several features enhance the overall visitor experience. First, the Visitor Center bookstore/gift shop and Glasshouse gift shop provide visitors with quality gifts and a superior selection of history books. Second, there are limited (but recently expanded) facilities for refreshment. Two water fountains are found outside the Visitor Center: one is at the footbridge restroom and the other is halfway into New Towne, near the Ambler House. Food and drink facilities have also opened during the spring of 2001 near the Dale House,

under a contract with the APVA. Cold drinks and a variety of light lunch items are available for purchase, with picnic tables nearby. At present, the operation is considered experimental, but current business has shown the venture profitable for the vendor, and it is hoped that plans for permanent concessions on the Island will be feasible. Third, several benches beneath the impressive stand of large shade trees in New Towne and Old Towne provide shade during peak summer visitation.

3.5.6 Visitor Characteristics

In an attempt to compile data on visitor characteristics, various agencies have completed surveys addressing visitor behavior and profiles. Combined statistics from the park and other sources provide some understanding of trends in use and interest, although details are limited. Furthermore, the majority of the data result from surveys of users of state facilities; assumptions have been made that many of these individuals also use NPS facilities.

In 1997 the Virginia Tourism Corporation (Virginia Tourism Corporation 1998) conducted a comprehensive visitor survey for the Jamestown-Yorktown Foundation. The survey assumed that many of the visitors who experienced the Jamestown Settlement and the Yorktown Victory Center would visit the nearby NPS sites as well. Survey questions included timing and length of stay, visitor background/origins, sites visited, and the types of activities in which visitors were involved at various sites. This information supplements the 1987 Colonial National Historical Park Visitor Use Survey data (University of Idaho 1988). The park conducted a visitor use survey in the summer of 2001 to update data and address gaps in other surveys, such as understanding the sequence of visitation between the area's historic sites and the length of time they spend at each site (University of Idaho 2001a).

In addition, a study done for the park in 1996-97 (Martin 1998) described the market context for visitation at Jamestown and other nearby attractions. The study described existing visitation patterns, projected future visitation as a result of the 2007 events, profiled current and future visitors to Jamestown, and assessed factors affecting visitation. It also included the results of a 200-visitor survey conducted by APVA to profile visitors to the Jamestown APVA/NPS archaeological site. Results of Colonial NHP visitor surveys, the Jamestown-Yorktown Foundation visitor surveys, and the market study analyses are described below in further detail, along with historical data.

During its first year of operation in 1931, Colonial NHP attracted 400,000 visitors, mostly at Yorktown Battlefield as a result of the 150th anniversary of the battle. The Parkway and Jamestown were not open to the public at that time. The Great Depression and World War II limited visitation significantly, but by 1952 annual park visitation had reached 1 million. Visitation reached 2.1 million in 1957 for the 350th anniversary. After dropping the following year, visitation increased dramatically during the 1960s, from 3.39 million in 1960 to the park's peak visitation level of 8.7 million in 1970. The decade of the 1970s saw fluctuations between 6 million and 8 million annually, with the majority of visitation numbers due to the Colonial Parkway usage. Due to a more conservative method of counting users on the Parkway, visitation numbers declined during the 1980s and 90s; by 1999 the annual visitation was recorded to be 5.09 million.

Over the past five years, the Jamestown and Yorktown Visitor Centers hosted an average of 689,351 visitors per year. In 2000 there were 698,894 paid visitors, of which 379,960 visited Jamestown Island. Prior to 1999, visitation statistics relied on hand counters at the Jamestown Visitor Center, but since that time have used computerized visitor profiles documented at the time payment is received at the gate. This generates more accurate

statistics, describing the type of vehicle people travel in, how many use the park pass versus the national pass, and how many are senior citizens and schoolchildren.

In comparison, visitation for Jamestown Settlement increased about 3% per year, with 512,000 visitors arriving in 2000. Their steady increase is a result of an aggressive marketing program and joint ticketing with Colonial Williamsburg and Busch Gardens, providing a five-day Revolutionary War Fun Pass. The most significant numbers, however, come from Virginia school groups. The Jamestown-Yorktown Foundation, which falls under the Commonwealth of Virginia's Education Department, provides a strong integrative educational program with schools that complement the state Standards of Learning requirements.

There is anecdotal evidence that visitors whose primary destination is Colonial Williamsburg also visit the park to enhance their understanding of colonial history. Annual paid visitation at Colonial Williamsburg has ranged between 950,000 and 1.2 million over the past 30 years, with peak years in the 1980s. In 2000 Colonial Williamsburg had 935,750 paid visitors. The Colonial Williamsburg Foundation estimates that three to five times as many unpaid visitors actually spend time and buy goods in the historic core.

There seems to be a clear annual pattern of shared visitation to the colonial history sites represented by the National Park Service, the state, and the Colonial Williamsburg Foundation. All sites have experienced increasing visitation in April and May, and September and October. June, July, and August remain high in visitation for all sites, with the peak month being July. The question remains what percentage of visitors comes to all of the sites.

It has been difficult to estimate how many people do not visit the park but use the Parkway either for recreation or commuting. In 2000, traffic counts were taken at key road intersections on the

Parkway to characterize vehicular traffic flow. Modeling projections were made for the park that are based on traffic counts taken at regular intervals over time. However, these figures cannot distinguish recreational traffic from daily commuter traffic.

The results of the 1997 visitor survey conducted by the Virginia Tourism Corporation support the findings of the 1987 park visitor survey defining the visitor profile (University of Idaho 1988). The survey assumed that many of the visitors who experienced Jamestown Settlement and Yorktown Victory Center would also visit nearby NPS-managed sites as well. Out of 3,277 "pleasure related" travelers surveyed, 613 responded. The results are as follows:

- Most U.S. visitors came from the surrounding Mid-Atlantic region: Virginia, Pennsylvania, Washington, D.C., New Jersey, North Carolina and Maryland, although the distribution of states of origin was diverse.
- In the summer, 3% of visitors were international. This number increased to 6% in the fall. The majority of international visitors came from Europe and Canada.
- Visitors were predominantly white, well educated, and relatively affluent.⁵
- Roughly 40% of park visitors were between the ages of 35 and 54; 42% were senior citizens. Age characteristics varied by season: roughly 50% of the visitors in the fall were over 51, while only 19% of summer visitors were over 51.
- Approximately 10% of the park's fall visitors were under 15, as compared to 28% in the summer.

⁵ 89% white, 62% having some college education, 40% with annual household income of \$60,000.

- Most visitors arrive in groups of two to four.
- School group attendance varies by season, with the highest volumes in spring and fall.

The July and August 2000 visitor survey performed by the Jamestown-Yorktown Foundation also highlighted the similarities in visitation between the Island and the Settlement (Hall 2001). A total of 589 surveys were conducted at the Settlement. Some of their key findings follow:

- Just over 75% of those surveyed at Jamestown Settlement had never been to Jamestown Island prior to their current visit to the Historic Triangle.
- 38% of those who reported visiting both sites had visited the Island before.
- 15% indicated that they had visited the Island prior to their visit to the Settlement.
- 28% did not indicate that they planned to go to Jamestown Island after visiting the Settlement.
- 66% cited a lack of time as the main reason they could not visit both sites.
- 93% of those who went to both sites described the quality and overall experience at Jamestown Island as either “good” or “excellent.”

The Virginia Tourism Corporation also asked the participants what activity or attraction motivated them to visit the area. The answers demonstrate the importance of other attractions in visitation to the park. Colonial Williamsburg was the top draw, attracting 70% of the tourists who also visited the state facilities at Yorktown and Jamestown. None of the respondents identified visits to state or national parks as their primary trip motivation. While there is no definitive understanding of the relationship

between visits to Colonial NHP and other regional attractions, the data suggest that colonial history enthusiasts typically visit numerous sites throughout the area.

The *Jamestown Long Range Interpretive Plan* (Colonial NHP 2000b) responded to the analysis of the earlier surveys and identified the need for the park to expand marketing and interpretive programming to target new and expanded audiences. These would include teachers and students (on- and off-site); home school students; adult “lifelong” learners; African-Americans; American Indians; local residents; and visitors experiencing the park on the Internet or through other media. Implementation of the various projects is dependent on staffing and budget, but some proposals are underway. The park is in the process of installing new waysides to update the interpretive themes on the Island. The park website now includes expanded historical and general information. In addition, the expanded *Jamestown Island Interpretive Plan* (Haley Sharpe Design 2001b) now includes a much higher level of detail on major and secondary themes. Integration of the themes will be consistent with the overall goals of the park and the National Park Service’s “The Road Ahead” strategy. That strategy identifies the need to expand educational programs to present diverse perspectives, look at collaborative opportunities for learning, link the Jamestown story to its global context, and capitalize on new and emerging technologies.

3.5.7 Americans with Disabilities Act (ADA) Accessibility

The level of accessibility related to the Americans with Disabilities Act (1990) varies throughout the Jamestown Project site, as described below.

3.5.7.1 Jamestown Visitor Center and Parking Lot

The correct number, location, and size of accessible parking spaces exist at the Visitor Center parking lot. Access from the parking lot to the concrete walk

and footbridge meet ADA codes, but the steeper (8.33%) slope of the walk past the footbridge requires a handrail and a landing every 30 feet, which is currently lacking. The entrance doors and the primary visitation area are on a single elevation, although access to the archives is in the basement and access to the lower door does not meet accessibility code. Current interpretive and informational signage is inconsistent with accessibility regulations, and lighting in the museum area is too dim. The restrooms in the public area are accessible, although the water fountain and public telephone are not. The doors into Theatre 1 are too narrow for proper passage, but there is an established wheelchair area in the theater. Furniture heights at the visitor information desk and store counter do not meet accessibility standards, and the staff break area, including access to the restroom and kitchen, does not meet minimum standards.

In terms of programmatic accessibility, the new orientation film has subtitles, making it accessible to people with hearing impairments, but there is no additional explanatory facilitation for people with visual impairments. Furthermore, the facility lacks a tactile orientation map of the site as well as alternative media formats to provide information found in the park brochure.

3.5.7.2 Footbridge Restroom and Water Fountain

Neither footbridge restroom nor the adjacent water fountain is accessible by current standards. The width of the entrance into the restroom is too narrow to allow wheelchairs to turn, and the type and height of fixtures do not comply.

3.5.7.3 Glasshouse

The Glasshouse parking lot contains enough accessible parking spaces in the correct location to meet the regulations. Interpretive material at this site is limited to an oral discussion of glassmaking that does not include provisions for people with impaired hearing, and a brief site description

through interpretive folders that do not include tactile information for people with impaired sight.

The restroom has recently been upgraded to include two new individual men's and women's single-user restrooms. The path to the restroom is not accessible due to the oyster shell and clay base material that is the standard trail material for the park.

3.5.7.4 The Jamestown Entrance Station and Booths

In general, the three structures do not meet accessibility standards. The trail that leads to the station and continues between the booths does not have adequate access or turning radii for people in wheelchairs to enter the buildings. The building entrances include stoops, and the restroom in the ranger station does not meet the space requirements for an accessible restroom.

3.5.7.5 The Yeardley House/Jamestown Rediscovery™ Center

The new addition has a brick walk and ramp at the correct slopes to provide accessibility to the first floor of the building, including access to research and archive rooms. Stairs provide access to the second floor, which accommodates office space for staff. Restrooms on the first floor meet accessibility codes.

3.5.7.6 The Dale House

The building entrance is at grade to the walk and can be accessed, although turning space within the exhibit area is too narrow for current requirements.

3.5.7.7 Fort Site, Archaeological Exhibit, and Church

All areas can be accessed at grade, but the turning radius within the church nave does not meet code. Considering its historic designation, required modifications would depend on the feasibility of making reasonable adjustments without destroying the historic fabric.

3.5.7.8 New Towne

The area is accessed at grade by trails, some of which are original historic roads, which are covered with crushed oyster shells and interspersed

wooden bridges over ditches. While the paths are accessible, some individuals in wheelchairs express a difficulty with the surface. The historic character of New Towne and the use of original roads in the trail system would need to be considered in any changes in the trail system.

3.6 OPERATIONS

Operations at Jamestown involve a cooperative arrangement between the APVA and the National Park Service. While the NPS owns the majority of the acreage, the APVA property includes several key attractions, including the Memorial Church and 1607 James Fort Site. For clarity, the two operations are discussed separately below.

3.6.1 APVA

The APVA has many levels of operations on its 22.5 acres at Jamestown Island. Most operations are maintained year-round. In calendar/budget year 2000, the operations detailed below were budgeted at approximately \$953,000. A breakdown by activity follows.

Visitor Services: The APVA cooperates with the NPS in providing interpretive services on a portion of the Island. While employees of the National Park Service staff the entrance gate, the APVA pays one-half of the operations cost for the facility, including staff time. The most extensive interpretive effort is through a corps of volunteers who assist visitors in orientation, provide interpretive information, and respond to questions. In the year 2000, 64 volunteers contributed 6,467 hours to the interpretive effort. A part-time site coordinator maintains an office in the north wing of the Dale House and manages the volunteer program. In addition to an office suite, the building houses an office where the volunteers begin and end their shift. It contains a small library and a restroom.

The APVA also provides paid interpreters stationed in the Memorial Church. Guides are present daily from April through November. They provide a short presentation to visitors and respond to questions. A staff of 16 interpreters shares the time, with two guides working per shift.

The Island also serves as the location for multiple special events, both APVA sponsored and by rental. The church is a popular location for weddings, and occasional commemorations are also held on the grounds throughout the year

Restoration Services: Jamestown Island is the location of the APVA Restoration and Maintenance Shop. This department is housed in an early 20th century structure called the Mule Barn. An adjacent small freestanding shed provides shelter for motorized equipment. The operation is headed by two restoration craftsmen, supported by a full-time lead maintenance worker. The landscape department is headed by one full-time person, supported by one year-round part-time worker and one seasonal part-time worker. In addition to a regular weekday schedule, this staff rotates weekend coverage to assure that the Island is clean and safe for visitors.

Archaeological Department: Jamestown Island is the site of an intensive ongoing archaeological investigation. A full-time staff of eight and a part-time staff of four carry forward the field investigation and the conservation, curation, and research of the artifacts recovered in the process. A field school sponsored in conjunction with the University of Virginia brings approximately 15 students on site for several weeks each summer.

The Jamestown Rediscovery™ Center (previously the Yeardley House) serves as headquarters for this effort. A dedicated addition provides long-term storage and research space for the artifact collection. A semi-permanent fabric structure provides shelter for observation and all-weather access for ongoing archaeology on this portion of

the dig. A partial palisade wall has been installed along the trace of the original fort line to enhance interpretation of the understanding gained from the first several seasons of investigation. An observation platform has been added along the south wall of the mid-19th century fort to aid visitor observation of the current site of intensive archaeology.

Residential: The APVA rents the small Godspeed Cottage as the principal residence of one of its employees. The residential component provides an around-the-clock presence on the Island for added security and safety.

Commercial: The APVA contracts with a local restaurateur to provide food service to visitors to the Island. This daily, seasonal operation is housed in a temporary structure adjacent to, and sharing utility services with, the Dale House. Employees of the contractor staff the facility. There are also two vending machines on the west porch of the Dale House providing drinks and light snacks.

3.6.2 NPS

Colonial NHP encompasses 10,221 acres. While most of the land is contiguous, there are several detached areas that are managed: Green Spring, the homesite of royal governor William Berkeley; Cape Henry Memorial, the site of the first landing of the English colonists in 1607, located in Virginia Beach; Swann's Point, an undeveloped area across river from Jamestown Island; and Tyndall's Point, consisting of Revolutionary and Civil War earthworks in Gloucester.

Operational activities are described below.

Staffing: Between 1994 and 1999, the park's operational budget remained constant at \$4 million. To keep up with the cost of living, salary, and general operational cost increases, from 1981 to

2000 staffing levels dropped from 125 full-time staff to 83. These reductions occurred in each division. In 2000 the park received a base increase of \$496,000, which, among other things, provided funds for three additional staff positions.

Administration: Colonial NHP's administrative staff consists of six FTEs including the administrative officer, personnel specialist, budget analyst, contract specialist, and office automation clerks. The staff provides administrative support for the entire Colonial NHP, which includes Jamestown. Approximately 30% of their time is devoted to support services for the Jamestown unit. Based on this, the 2000-01 operational cost for administration services to Jamestown is \$156,000.

Interpretation: The NPS uses a combination of paid staff and volunteers to provide interpretive services at Jamestown Island. Currently, 10 full-time staff members operate the Visitor Center and the entrance station booths. In addition, depending on funding, the NPS hires four to six seasonal staff to augment the interpretive and entrance station operations. The staff can generally be categorized as interpretive and visitor use assistants, the Jamestown district historian, the curator, and a museum technician. Visitor use assistants operate the entrance fee program and orient visitors to Jamestown.

Interpretive staff provide interpretive programs and tours of New Towne, research new materials, update program themes, and plan for special programs. They also provide special tours at Green Spring upon request, and are required to walk the remote sites of the Island and Swann's Point at least twice a year to ensure that the sites have not been vandalized. The curator and museum technician oversee the park's archives. The museum technician position is shared equally between Yorktown and Jamestown, and therefore only 50% of his salary is included in the operational costs.

Volunteers are an essential component of the Visitor Center functions. Although the numbers fluctuate seasonally, there are currently 18 volunteers who assist park staff in visitor services. Up to three student interns each year participate in interpretive or special programs.

The 2000-01 operational cost for interpretation is \$405,894.

Resource and Visitor Protection: The park has six full-time protection rangers (down from 10 in the late 1980s) who are responsible for patrolling the entire park. The park devotes \$883,895 of the operations budget for protection activities parkwide. This figure includes the administrative and dispatch functions of the protection operation. The rangers are responsible for the full range of protection duties, including law enforcement (patrol, criminal and accident investigations), emergency medical care, wildland fire suppression, and response to search and rescue incidents. Rangers must provide patrol and response coverage 24 hours per day. All told, providing protection services to the Jamestown area takes roughly 20% of the protection budget, or \$176,779.

In addition to protection rangers, maintenance staff (discussed below) is trained to identify and report any safety violations or potential safety problems while they are in the field. Many of their maintenance activities are preventive – repairing or replacing potentially hazardous structures and landscape features. Current staffing levels limit these efforts, but the most serious problems are always addressed.

Protection for the Jamestown area of the park is inadequate. Greater frequency of patrols and monitoring would increase resource and visitor protection. Several servicewide and park goals under the Government Performance and Results Act relate to resource protection and visitor safety activities. The protection staff has focused

significant resources to traffic enforcement on the Colonial Parkway since motor vehicle accidents on the roadway are the leading cause of visitor accidents/injuries in the park.

Natural Resource Management: The Colonial NHP Natural Resources Division consists of two full-time staffers – a natural resource manager and a Geographic Information Systems (GIS) specialist. The natural resource manager is responsible for obtaining funds for and contracting out inventory and research projects. He is also the Integrated Pest Management coordinator, and deals with emergencies such as hazardous waste spills, on and off park property. When funding is available, he hires part-time or seasonal interns to do field work related to inventory and monitoring of various projects.

The GIS specialist is responsible for updating and managing the park's GIS database. In addition, he provides maps to other park divisions for projects relating to cultural resources and construction and planning projects.

The total 2000-01 budget for this division is \$146,105. This includes staffing, equipment, and supplies. Staffing and support costs for interns come out of specific natural resource-initiated projects funded from the regional or Washington office.

Facilities Management: The park's maintenance division currently employs 40 full-time personnel, down from 80 in the early 1980s. The division is responsible for providing maintenance to both Yorktown and Jamestown Visitor Centers and the surrounding grounds; the landscape and infrastructure of the Colonial Parkway and 22 miles of tour roads; 36 miles of earthworks, various monuments, a formal garden, and one National Cemetery; 1,000 signs, three dams, 85 historic structures, and 62 modern structures; and Cape Henry and Green Spring.

Maintenance facilities are located at both the Yorktown and Jamestown areas. Six staff are stationed at the Jamestown Maintenance Facility, including one assigned to the Visitor Center/Glasshouse to provide cleaning and trash disposal. They are responsible for basic maintenance along the parkway up to the Williamsburg tunnel. They are also responsible for the annual mowing and minimal maintenance required for Green Spring. Utility system specialists and skilled tradesmen, located at Yorktown, service all park facilities.

The park maintenance budget for 2000-01 was \$2.1 million, and has been adequate only for basic needs such as cleaning main visitor facilities, maintaining historic structures, mowing grass, and removing hazardous trees. Additional funds through congressionally authorized programs pay for work that cannot be covered under the park's base account. These include, but are not limited to, cyclic maintenance and highway construction programs. Current funding levels do not adequately allow the park to keep up with maintenance needs. Many structures and landscapes are in great need of attention and repair.

The total Jamestown facilities budget for 2000-01 is \$630,000. This includes staffing at Jamestown and additional technical support from Yorktown. It also includes equipment, and supplies for basic maintenance.

3.7 BUILDINGS AND UTILITIES

Existing buildings and utilities at the Jamestown Project site are depicted in Figures 3-32 to 3-35.

3.7.1 Buildings

3.7.1.1 Jamestown Island

The NPS manages visitor centers at Jamestown Island and Yorktown. Together, they occupy a total of 54,000 square feet of office, exhibit, and visitor interpretive space. The Jamestown Visitor Center is 27,000 square feet, which includes archival storage in the basement. The current space given to staff and archival storage is inadequate. Permanent interpretive staff share one office space with desk cubicles, and volunteers and seasonal staff share one to two cubicles on a rotating basis. The archival collection contains approximately 400,000 artifacts, and has reached capacity. Additional artifacts, from the archaeological surveys performed at Jamestown Island and Green Spring, are waiting to be catalogued.

The NPS also owns several other structures on the Island. These include the historic Ambler House and the 1907 Tercentennial Monument. In addition, there is a six-stall restroom on the footpath between the main parking area and the Visitor Center. This facility is adequate for current needs.

The APVA buildings are more concentrated, given the acreage of APVA property. The historic church located on the property hosts events, such as weddings, as well as visitors. The Dale House serves as an office for the APVA site coordinator and contains a library and restroom. Contracted food service also utilizes this building. The Mule Barn houses the APVA Restoration and Maintenance Shop. The Yeardley House/Jamestown Rediscovery™ Center serves as headquarters for the summer field school. Finally, the APVA rents the Godspeed Cottage to one of its employees.

3.7.1.2 Glasshouse Point

The National Park Service owns several structures on Glasshouse Point, both historic and modern, as detailed below.

The area includes the ruins of the original Glasshouse, which are protected by a 1970s enclosure. The condition of the archaeological resources is deteriorating due to inadequate ventilation. The 20th century Glasshouse memorial, which commemorates the first known industrial enterprise in America, is also located in this vicinity.

At the modern Glasshouse kiln site, which is meant to look somewhat like a 17th century glass manufacturing operation, active glassblowing provides both living history interpretation and products for sale. It is in good condition and is considered adequate for current visitation, although additional space is needed for sales. A six-stall restroom is also located at this site. It is currently being renovated, and two new handicapped-accessible stalls are being added. During peak and near-peak times, the number of stalls is inadequate to handle large busloads of people.

In addition, there is a 500-square-foot building of unknown age that provides a small office space for Eastern National, the cooperating association that handles the operation of the Glasshouse kilns. The building is old and deteriorating, despite regular maintenance, and its storage and office spaces are considered inadequate for staff needs.

3.7.1.3 Neck of Land

Colonial NHP owns two maintenance facilities, totaling 40,000 square feet. The primary facility is located in Yorktown, where the facility manager and the majority of the administrative and maintenance staff are headquartered. The other location is at the Neck of Land. Finished for the 1957 opening of the Parkway, it is a much smaller operation than the one in Yorktown. Staff at this location maintain Jamestown Island, Glasshouse

Point, and Green Spring, and also perform annual visitation to Swann's Point by boat.

Facilities include a small supervisor's office, lunchroom, fire cache, carpenter's shop, and parking bays for vehicles and equipment. Current space is inadequate for equipment and staff needs, even at the current low staffing levels. Reduction in employee numbers and changes in technology have caused the park to depend on more mechanized equipment such as large mowers, chainsaws, tractors, and trucks to keep up with maintenance needs. The increase in equipment has caused a shortage of storage areas at Jamestown. Front-end loaders and dump trucks, as well as bulk materials and supplies for Jamestown, are stored at Yorktown until needed.

3.7.2 Utilities and Stormwater Management

This section addresses the location, age, and capacity of the utility systems that serve the NPS and APVA facilities. In addition, the discussion includes information about planned utility improvements. This assessment includes the following utility systems:

- Electric service,
- Natural gas,
- Telecommunications,
- Cable television,
- Water supply,
- Sanitary sewer service, and
- Stormwater management and drainage systems.

In general, findings are based on the review of existing published information and interviews with NPS, APVA, James City Service Authority (JCSA), and franchise utility personnel.

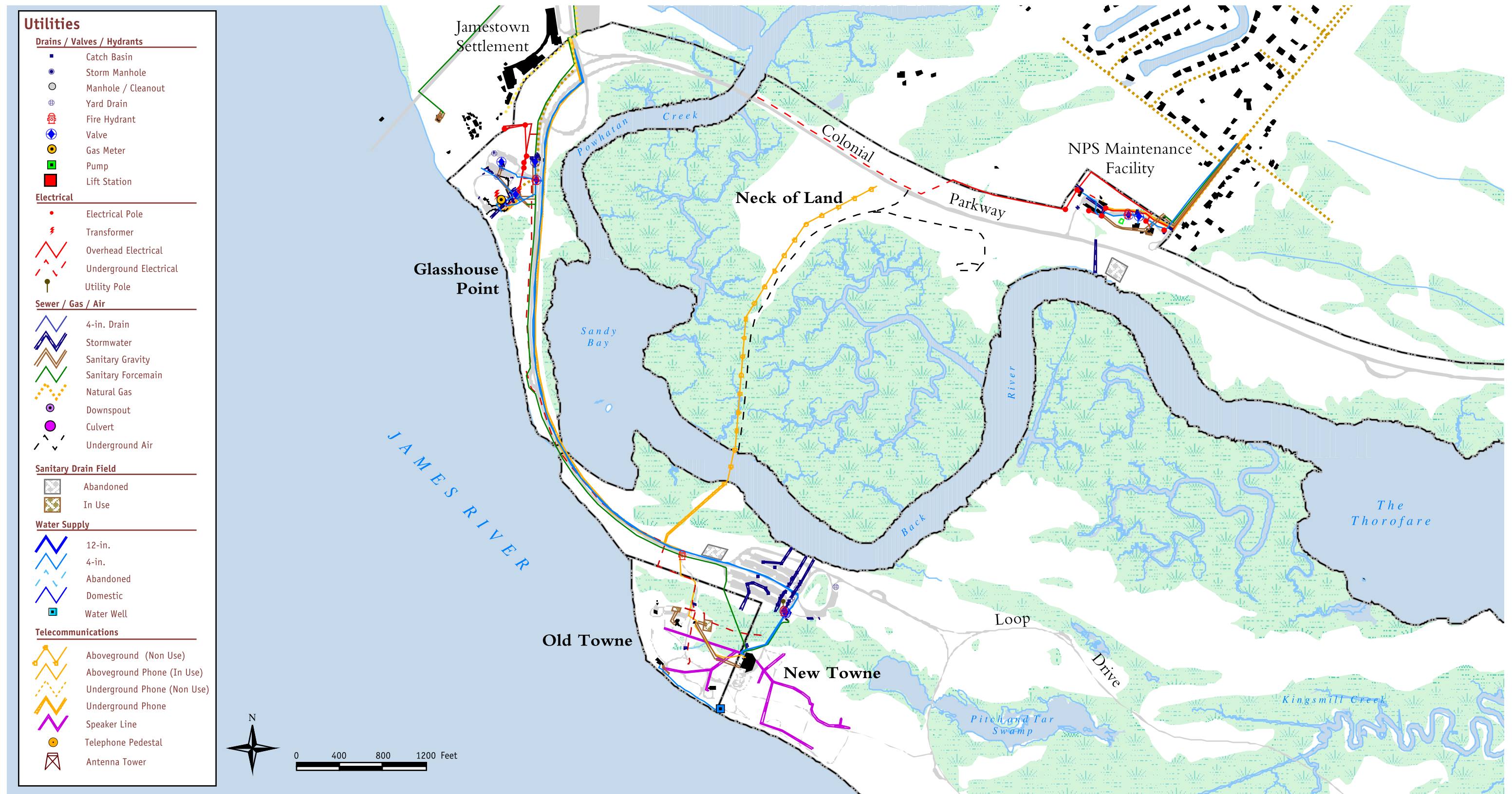


Figure 3-32: Overall Buildings and Utilities

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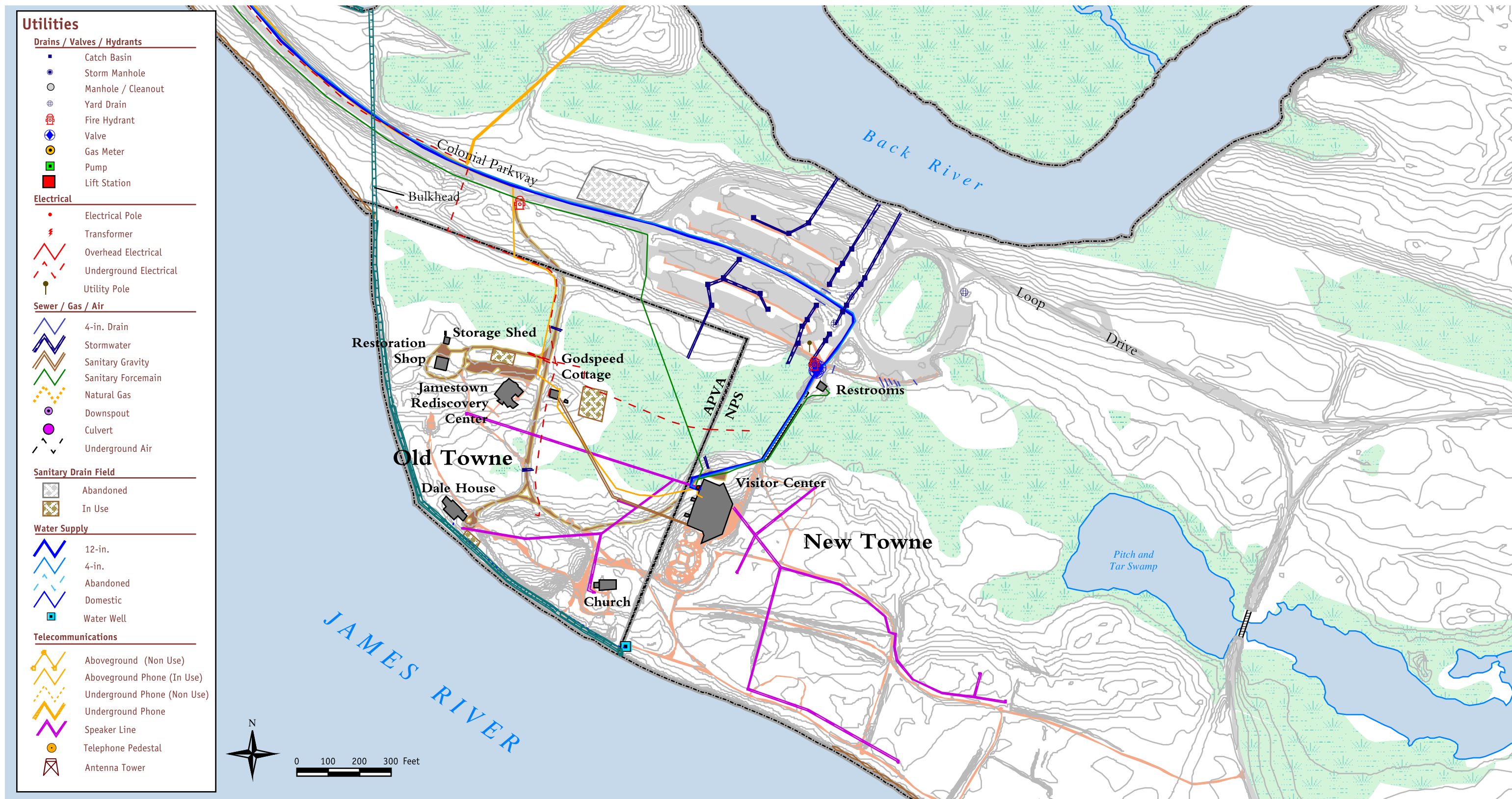


Figure 3-33: Buildings and Utilities - Townsite

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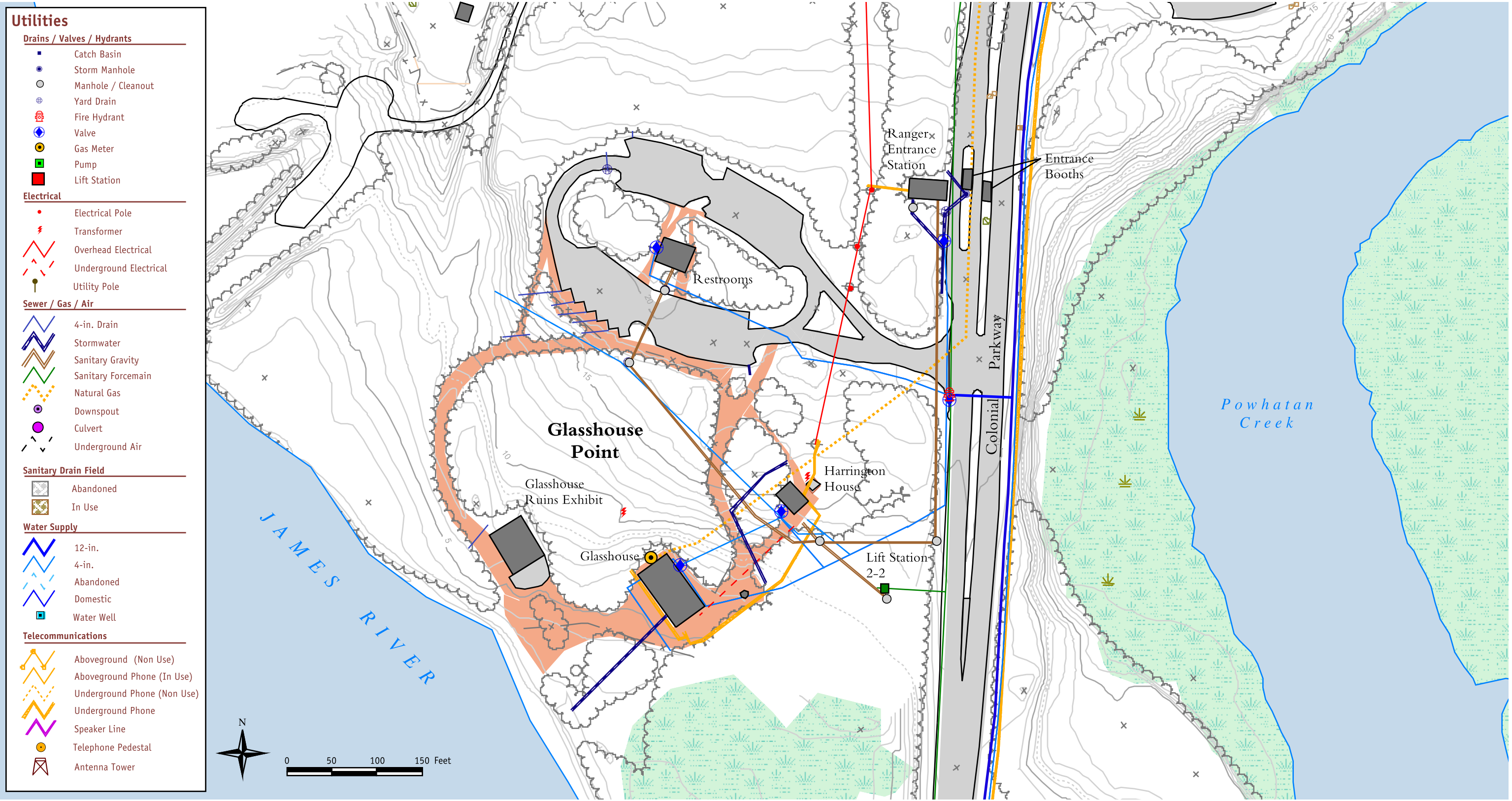


Figure 3-34: Buildings and Utilities - Glasshouse Point

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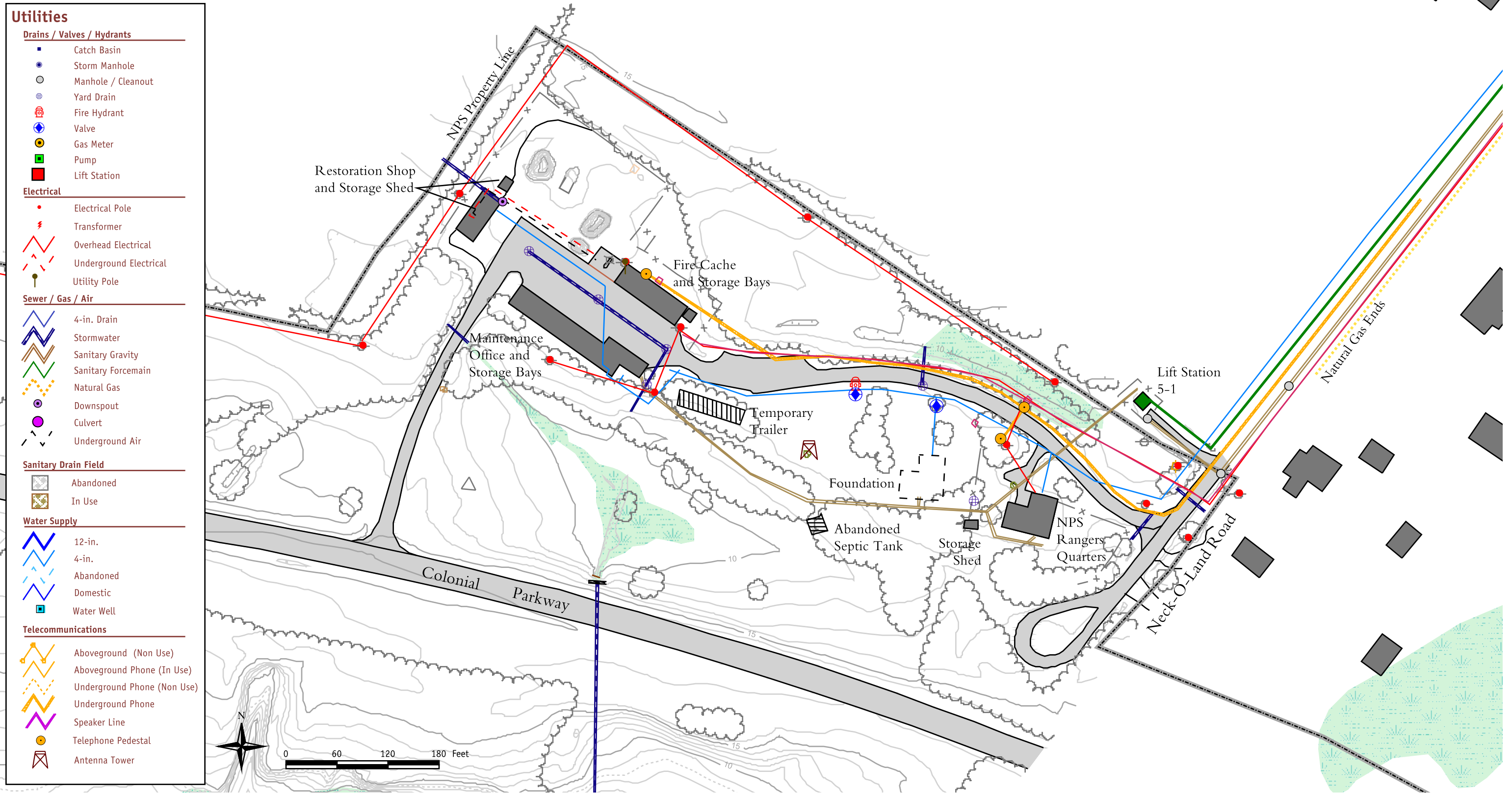


Figure 3-35: Buildings and Utilities - Maintenance Yard

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3.7.2.1 Summary of Findings and Conclusions

The following highlights summarize the findings of the utility assessment. A more detailed profile follows the summary.

- According to Dominion Virginia Power, sufficient electrical service availability and capacity exist for redevelopment. Dominion Virginia Power personnel have compiled a history of outages in the Jamestown area to ascertain problematic areas, and have taken incremental steps to enhance service. Any new development will need to emphasize redundant power supply (the addition of backup service) to minimize peak period outages that have plagued the NPS in recent years.
- Natural gas service is presently limited to the Glasshouse; however, infrastructure exists nearby to serve additional uses on Jamestown Island, if necessary. Available capacity and pressure compatibility with redevelopment demands will require a study by Virginia Natural Gas engineers.
- Neither the NPS nor the APVA uses cable television service. However, service is available in the vicinity of the Jamestown area.
- The James City Service Authority (JCSA) supplies water to the NPS. JCSA serves the NPS Maintenance Facility and the Jamestown Island areas with separate supply systems. Each system is reportedly adequate and in good condition, with the Jamestown Island system having been installed in early 2001. Both supply systems are for domestic use and fire protection. APVA facilities produce a limited water supply by well source.
- Telecommunications service is provided by Verizon and is adequate for present needs. However, capacity requirements for any new

development by the NPS and APVA must be evaluated closely. Fiber optic lines and high-speed Internet access are not yet available to Jamestown Island; however, infrastructure is within reasonable distance to provide connections to the property.

- The JCSA also provides sanitary sewer services to the NPS Maintenance Facility and Visitor Center. Sanitary septic tanks and drainfields serve APVA buildings.
- Stormwater collection and conveyance is managed by several isolated open- and closed-channel drainage systems. These systems appear to operate adequately for normal storm events. However, most culverts and ditches do not operate at capacity due to a lack of maintenance. Additionally, it appears that most of the culverts are undersized for their drainage areas. An analysis of each culvert should be part of any alternate design to ensure public safety and minimize prolonged flooding during heavy storms. Heavy silt and vegetative debris buildup is common throughout the project area. Water quality and water quantity mitigation and attenuation is lacking on-site.

3.7.2.2 Utility Findings

Specific findings are as follows:

Electric Service

Dominion Virginia Power provides electric service via radial (single-line or dead-end) feeds. Radial power feeds are part of the reason several outages have occurred at Jamestown Island. Power is supplied in only one direction with a radial feed, versus two directions on a looped feed. Interviews with NPS and APVA personnel indicate that power outages are common on the Island and have lasted several days; although power demands created by Jamestown Island are not the cause of outages. Dominion Virginia Power recognizes the outage problem and is augmenting its circuitry, reducing

the number of radial feeds to minimize widespread outages. The improved circuitry will localize power failures and minimize the amount of down time to Jamestown Island and the NPS Maintenance Facility.

Separate radial power feeds supply power to the NPS Maintenance Facility at the south end of Neck-O-Land Road, the Visitor Center, and APVA property on Jamestown Island.

Three-phase, 34.5 KVA (1,000 voltage amperes) overhead lines run south on Neck-O-Land Road and supply power to the NPS Maintenance Facility. This power comes from the Waller Mill substation, several miles away. A secondary power line runs underground from the NPS Maintenance Facility to the bridge at Powhatan Creek for nautical lighting.

Jamestown Island's facilities, including the Glasshouse, APVA buildings, and the existing Visitor Center, receive power from Dominion's Lightfoot substation via Jamestown Road with three-phase, overhead 19 KVA lines to the Glasshouse. Step-down transformers are located near the Glasshouse to supply underground 7,600 VA to Jamestown Island. NPS personnel have reported that numerous outages and subsequent splicing of power lines took place before step-down transformers were installed near the Glasshouse to reduce the problems. According to Dominion Virginia Power personnel, the step-down transformers are located near Harrington House.

Dominion Virginia Power personnel have not recovered any records of easements for power facilities on Jamestown Island. However, the utility company maintains the power supply to the Island.

Natural Gas

Virginia Natural Gas is the regional provider of natural gas to the Virginia Peninsula and the Jamestown area.

Virginia Natural Gas provides regional distribution to the Peninsula via a transmission line rated at 1,200 pounds per square inch (psi). The regional system's operating pressure average is about 700 psi. Virginia Natural Gas monitors and regulates pressure in its local Peninsula distribution systems with gate stations. The gate station that monitors the Jamestown area is located to the southeast in the Patrick Henry Mall area. No regional gas distribution supply or distribution issues were uncovered.

Local service to Jamestown Island is limited; only the Glasshouse uses natural gas. The Glasshouse is fed via a 2-inch plastic main, rated at 60 psi. This main extends onto NPS property from Jamestown Road. Gas service does not extend to the Visitor Center or APVA property.

The NPS Maintenance Facility does not use natural gas, although service is nearby. A 2-inch plastic main, rated at 60 psi, exists along the southeastern side of Neck-O-Land Road. This 2-inch main extends about 300 feet south of Constance Avenue. Virginia Natural Gas reports that, based on current demands and residual pressure in this main, it is adequate to service the NPS Maintenance Facility. Connecting the facility would necessitate extending the gas main approximately 800 feet. Additionally, a local looped system may have to be installed to ensure reliable service.

Telecommunications

Verizon, which provides telecommunications service to the area, has reported that overhead telephone lines serve the maintenance center from Neck-O-Land Road. A 100-pair copper service exists on Neck-O-Land Road; from there, a 50-pair service leads into the NPS Maintenance Facility. Verizon maintains these overhead telephone lines. Fiber optic service does not yet extend to the maintenance area; however, Verizon has installed fiber optic lines to the intersection of Neck-O-Land and Lake Powell Roads, about 7,000 linear feet north of the facility. This service is adequate for

existing operations at the NPS Maintenance Facility; although, Verizon encouraged further discussions regarding improvements to serve any expanded telecommunication needs, given the likelihood that capacity issues may arise.

Jamestown Island's telecommunication service is provided via a 100-pair, underground service that extends from Jamestown Road through Jamestown Settlement property. This 100-pair service generally follows the Colonial Parkway, south of Route 359 to the Glasshouse and Visitor Center areas. Verizon has stated that its maintenance responsibilities end at its remote station on Jamestown Road and that all underground lines beyond that point are private. Similar to the service for the NPS Maintenance Facility, this service is adequate for existing Jamestown Island operations. However, Verizon again encouraged further discussions regarding improvements to serve any expanded telecommunication needs.

Fiber optic service does not yet extend to Jamestown Island; although, Verizon has installed fiber optic lines to the intersection of Jamestown Road and Route 359. Digital subscriber lines, which provide high-speed Internet access, are not yet available to the area. Verizon stated that it plans to provide this service to the area in the next few years.

Cable Television

According to NPS and APVA personnel, cable television service is available in the vicinity of Jamestown Island and is currently used only for the park ranger's residence on Neck-O-Land Road.

Water Supply

JCSA provides water supply to the NPS for fire protection and domestic water. Separate services extend to the NPS Maintenance Facility and to the Visitor Center area. One fire hydrant is located on the NPS Maintenance Facility grounds. Additionally, fire hydrants are located at the Glasshouse entrance, APVA entrance, and at the footbridge restrooms. A 4-inch waterline extends

from the footbridge restrooms to the Visitor Center for the Visitor Center fire suppression system. Facilities on Jamestown Island that are owned and maintained by the APVA are supplied water via a private well for domestic use only.

Water for the NPS Maintenance Facility is supplied via an 8-inch-diameter plastic main on Neck-O-Land Road. From Neck-O-Land Road, an 8-inch-diameter service lateral extends roughly 400 feet down the facility access road. This service lateral is then reduced in size twice before reaching the NPS Maintenance Facility water meter, first to a 4-inch line and then to a 2-inch line. It is estimated that the waterlines serving the facility were constructed around 1978. There have been no major service problems or maintenance issues according to JCSA and NPS personnel. Information about available fire flows and pressures within the maintenance center service lines has been requested but has not yet been received. (Note: Two abandoned water wells exist at the NPS Maintenance Facility.)

JCSA has recently installed new domestic and fire protection water mains to the NPS facilities on Jamestown Island. These additions should improve water pressure and supply problems that NPS personnel have cited during peak summer months. A 4-inch plastic main provides domestic water service, while a 12-inch ductile iron pipe provides fire protection service. These new lines extend from a 12-inch distribution main in Jamestown Road, south along Route 359 and the Colonial Parkway to the east end of the Visitor Center parking lot. From this point, separate 4-inch domestic and fire protection water lines serve the Visitor Center building. According to JCSA personnel, current information about available flows and pressures within the new domestic and fire protection water mains is not yet available; however, domestic and fire protection capacity should not be a problem.

According to the JCSA, upgrades to the above systems should not be required for minor proposed improvements. However, each system should be

analyzed on a case-by-case basis for adequacy of flow and residual pressures. In addition, the National Park Service may elect to provide a fire pump to ensure safety of artifacts.

Before the new Jamestown Island water mains were installed, the Visitor Center was on a private well system. The well has since been filled and capped. A domestic supply well exists south of the Visitor Center at the southeastern end of the seawall. It appears the well may be on NPS property near the archaeological site for the original fort. Water is pumped from this well to a storage tank at Dale House. Water from the storage tank is then piped through small-diameter service lines to the Yeardley House/Jamestown Rediscovery™ Center and Godspeed Cottage for general domestic use only.

Sanitary Sewer Service

JCSA provides sanitary sewer service to the NPS Maintenance Facility and Visitor Center on Jamestown Island. The service authority is now upgrading its force main pump station systems in the project area. Both sites ultimately discharge to a Hampton Roads Sanitation District force main at the intersection of Jamestown Road and Route 199.

The NPS Maintenance Facility is served by a gravity system that drains to JCSA pump station 5-1 located at the intersection of Neck-O-Land Road and the NPS Maintenance Facility access road. The station is adequate for some new development to the area. JCSA rates Pump Station 5-1 at 60 gallons per minute (gpm) with a service area of about 2,000 feet. The pump station was last tested in 1996 and was operating at a flow rate of 20 gpm. The small size and shallow depth of the 6-inch gravity pipe at the NPS Maintenance Facility may cause constraints on the maximum reach and carrying capacity of the new or existing system. An analysis of the system is required for any proposed additional flows. This site was served by a sanitary drain field system located on the southeastern side of the Colonial Parkway near the NPS Maintenance Facility. The system was partially removed and abandoned several years ago.

JCSA and three private drainfields serve Jamestown Island. JCSA pump station 2-3 is located on the northwestern side of the Visitor Center. The pump station receives flows from the Visitor Center and footbridge restrooms. A grinder pump that conveys flows to pump station 2-3 via a 1¼ -inch force main serves the footbridge restrooms. The grinder pump is managed and maintained by NPS personnel. Flows from pump station 2-3 are conveyed via a 4-inch force main to a 6-inch PVC force main that runs about 6,600 feet to an 8-inch PVC force main on Route 31. The 8-inch force main conveys flows to JCSA lift station 1-1. The 8- and 6-inch force mains were placed in service in the early and mid-1970s, respectively. According to JCSA personnel, adequacy of the force mains is very good, and they may accept additional flows. The 6- and 8-inch force mains have operated with very little maintenance since installation.

Pump station 1-1 has limited additional flow capacity. JCSA is now upgrading its system in the project area. Lift station 1-1 will have additional capacity once construction is complete. It will be beneficial to monitor JCSA progress.

Sanitary drainfields serve Yeardley House/Jamestown Rediscovery™ Center, Godspeed Cottage, and the Dale House. These drainfields are located on the northerly, easterly, and southeasterly sides of the buildings, respectively. Construction plans are underway to eliminate the drainfields for the Jamestown Rediscovery™ Center and Godspeed Cottage. The Dale House is to remain on a septic tank and drainfield. Grinder pump and force main systems are proposed for Yeardley House and Godspeed Cottage. The installation of these systems should be coordinated with any alternative development plans currently under review.

3.7.2.3 Stormwater Management and Drainage Systems

Stormwater collection and conveyance systems consist of both open- and closed-conveyance systems throughout Jamestown Island and the NPS Maintenance Facility.

At the NPS Maintenance Facility, the impervious areas drain to yard inlets and a closed-pipe system that is generally clear of debris and silt buildup. Stormwater runoff in paved areas appears to drain well, as there are no visible signs of low spots. The piped system discharges to an open channel that flows south, crosses via a culvert beneath the Colonial Parkway, and drains into the Back River. The open channels between Colonial Parkway and the NPS Maintenance Facility have not been well maintained, and water reportedly stands for long periods after heavy storms. However, this system is downstream of a sizeable watershed and the downstream culverts do not appear to be sized for peak stormwater runoff rates. The rate of stormwater runoff from the NPS Maintenance Facility is not attenuated by a pond or any other means. Water quality is somewhat attenuated by the use of a vegetated open ditch between the maintenance center and the Back River.

In the vicinity of the Visitor Center and APVA property, isolated drain inlets and stormwater collection piping exists. Otherwise, the majority of the site drains naturally to the adjoining waterways. The lack of regular maintenance of stormwater collection facilities and channels is somewhat apparent. In several locations, culverts are severely silted up, and ditches have silted up to the point they are not well defined. The rate of runoff from the Visitor Center parking field is not attenuated by a pond or any other means. Water quality is somewhat attenuated by the use of vegetated, open ditches and lateral sheet flow over pervious areas.

Since the NPS originally improved Jamestown Island, significant progress has been made in understanding and promoting the need for water quality, particularly with respect to stormwater runoff. Today, several regulatory statutes exist on the local, state, and federal levels that mandate water quality protection through the implementation of appropriate design standards, including Best Management Practices. It is very

likely that Jamestown Island's existing stormwater runoff collection systems have not been designed and installed to comply with all current water quality requirements.

3.8 TRANSPORTATION AND SITE ACCESS

The Jamestown Project site is located in James City County, Virginia, within the greater Williamsburg area on the Virginia Peninsula between the York and James Rivers. The Island is directly accessible from the Colonial Parkway. Regional access to the Williamsburg area is provided primarily by Interstate 64 but also to lesser extents by U.S. Route 60, State Route 5, State Route 31, and U.S. Route 17. The regional roadway network is shown in Figure 3-36. Jamestown Island does not have direct connections to these regional roadway corridors, except for U.S. Route 17, which connects to the Colonial Parkway at Yorktown. Access from I-64 and U.S. Route 60 is made using State Route 199 and State Route 132. Route 31 can be reached from the Colonial Parkway via State Route 359, and Route 5 can be reached by Greensprings Road (secondary Route 614). The Colonial Parkway can be accessed most directly from I-64 using Exit 242 (State Route 199) or Exit 238 (State Route 143).

3.8.1 Existing Transportation Network

3.8.1.1 Local Roadway System

Vehicular access to and from Jamestown Island is provided by the Colonial Parkway, which terminates at the Jamestown Visitor Center parking lot. Most of the 23-mile parkway is a two-lane, undivided roadway, with a center passing lane and graded grass shoulders. The total paved roadway width is 33 feet with no pavement markings. The posted speed limit is 45 miles per hour (mph). The local transportation network immediately surrounding Jamestown Island is shown in Figure 3-37.

The Parkway connects Jamestown Island with Williamsburg and the Yorktown Battlefield unit of Colonial NHP, with limited access provided only at a few locations. One of the few at-grade intersections along the Parkway is located immediately northwest of Jamestown Island at its intersection with State Route 359. The Parkway has a four-lane divided cross-section at this location with a 35-foot-wide grass median. An overlook parking area, located on the south side of the Parkway, is accessible from an entry drive that represents the fourth leg of the intersection with Route 359.

Route 359 is a short roadway connecting the Colonial Parkway with Route 31. Route 359 provides the primary entrance to Jamestown Island via Route 31. Route 359 passes directly through the state-owned and -operated Jamestown Settlement with the visitor parking lot located on the north side of the road and the Settlement on the south side of the road. Route 31 is a two-lane arterial roadway connecting directly with Routes 5, 614, and 199. The Colonial Parkway connects with Route 199 on the south side of Williamsburg and Route 132Y in Williamsburg proper. Route 132Y provides the primary entrance to the access and parking system of the Colonial Williamsburg Visitor Center. Both Routes 199 and 132Y provide access to U.S. Route 60 and I-64.

Since 1957, Virginia Route 31 has been the primary transportation route between the City of Williamsburg to the north and Surry County to the south via the VDOT-operated Jamestown-Scotland vehicle/passenger ferry. This two-lane undivided roadway has a posted speed limit of 45 mph.

The ferry loading area is located at the southern end of Route 31 in James City County, adjacent to the Jamestown Settlement. The ferry is a free, around-the-clock service that crosses the James River 43 times per day using a fleet of four ferry boats. The travel time on the ferry is approximately 20 minutes one-way. The ferry runs every 25

minutes each way during the morning and evening rush hours, every 30 minutes during the middle of the day, and hourly between 8 p.m. and 5 a.m. Service increases on Friday through Sunday during the summer (June through August).

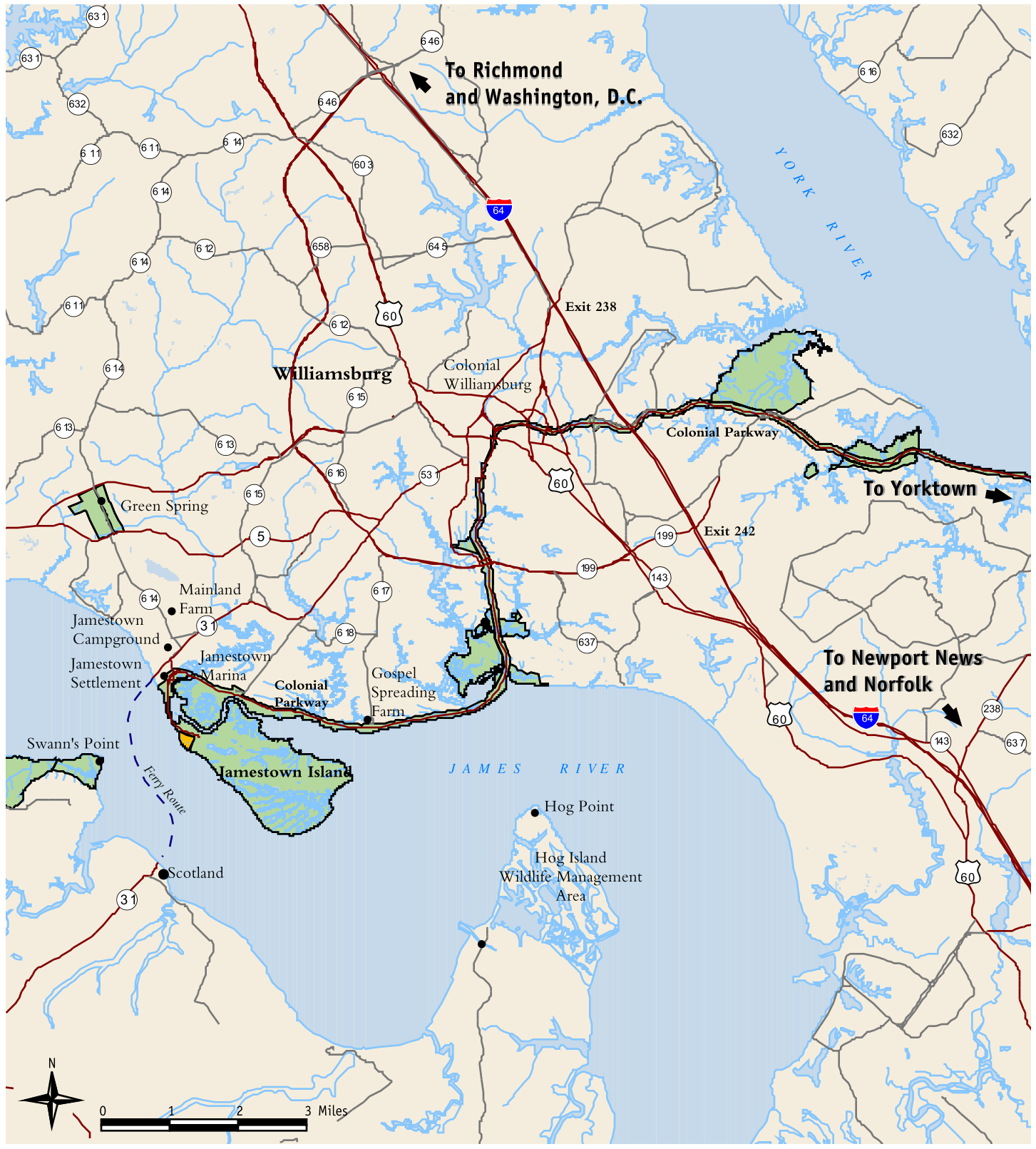
3.8.1.2 Jamestown Island Circulation

Entry to Jamestown Island from the Colonial Parkway is currently controlled at an entrance station. Two entrance lanes are provided; however, the second lane is open only during peak visitation days. From the station onto the Island, the Colonial Parkway narrows to a two-lane undivided roadway.

On Jamestown Island, separate parking lots are provided for the Visitor Center and the APVA staff. East of the Visitor Center lot, a 5-mile long, internal two-circuit Loop Drive provides vehicular access into the Island. Access to the Loop Drive is limited because of the 5-ton weight limit set for the bridges. Both pedestrians and bicyclists share the road with vehicles. Anecdotal information provided by NPS staff did not identify any circulation problems with the operation of the Jamestown Island Loop Drive.

3.8.2 Existing Traffic Volumes

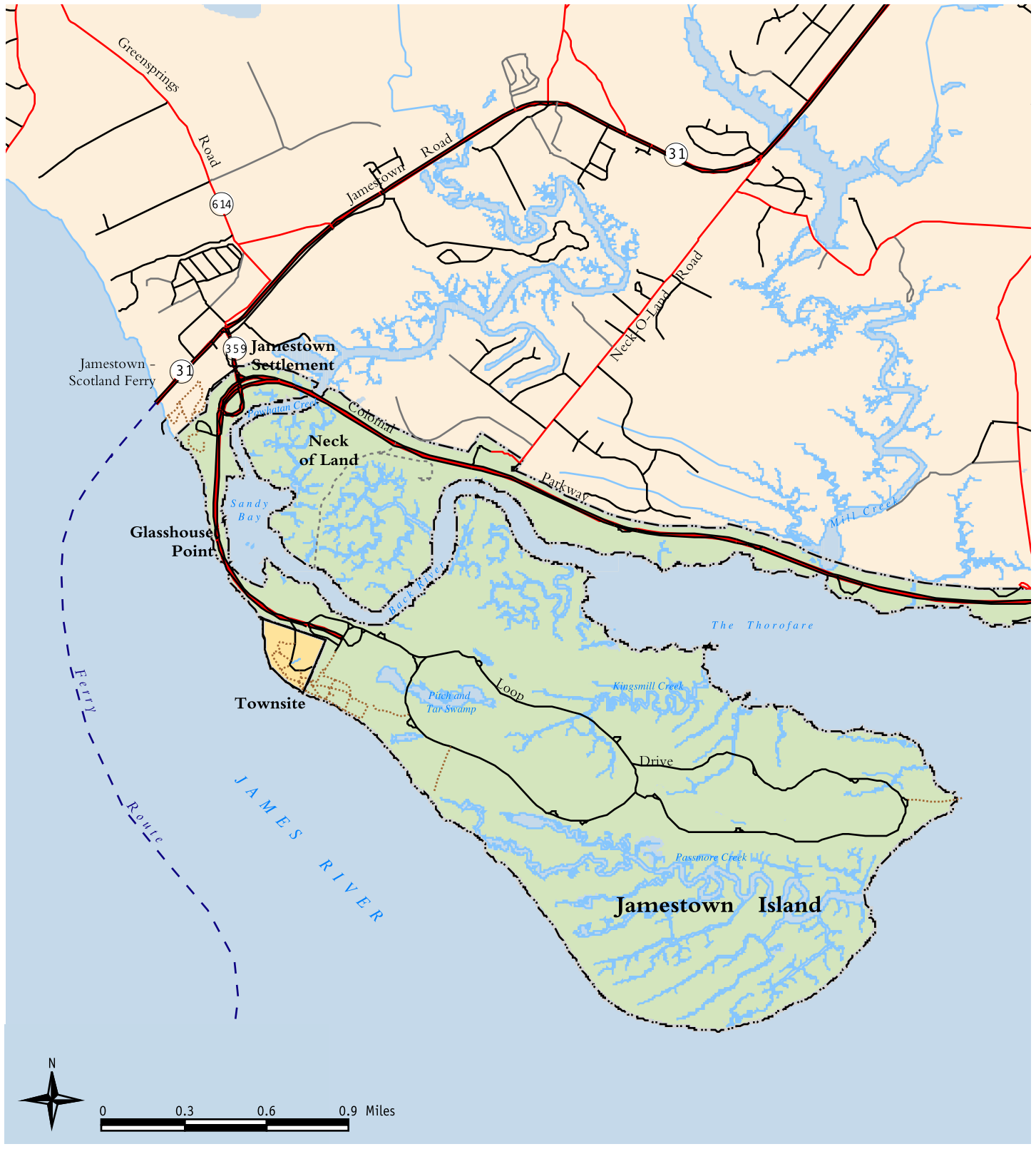
Existing weekday traffic volume data was collected on the Colonial Parkway and Route 359 during the 2000 summer season as part of the NPS-sponsored *Alternative Transportation System (ATS) Study* (BRW and Cambridge Systematics, Inc. 2001) for Colonial National Historical Park. In addition, daily and hourly traffic volume data was collected on Route 31 and Route 359 during April and May of 2001 in connection with the preparation of this environmental document. Table 3-36 displays the daily and peak hour traffic volumes recorded on key roadways in the vicinity of Jamestown Island.



Legend

- Primary Route, Class 1
- Secondary Route, Class 2
- - - Ferry Route
- Colonial National Historical Park
- Association for the Preservation of Virginia Antiquities

Figure 3-36: Regional Transportation Network



Legend

- Primary Route, Class 1
- Secondary Route, Class 2
- Road, Class 3
- Road, Class 4
- Road, Class 5
- Road in Service Facility, Rest Area, or View Point
- - - Abandoned Road
- Footbridge
- - - Trail
- - - Ferry Route
- Colonial National Historical Park
- Association for the Preservation of Virginia Antiquities

Figure 3-37: Local Transportation Network

Table 3-36: Existing Daily Weekday Traffic Volumes near Jamestown Island

| Location | Date of Count | Daily Traffic Volume (Two-Way) | Peak Hour Traffic Volume (Two-Way) |
|---|-----------------------|--------------------------------|------------------------------------|
| Colonial Parkway from: | | | |
| – East of Route 359 | June 2000 | 2,480 | 233 (4-5 p.m.) |
| – River shoreline to Route 199 | June 2000 | 3,340 | 363 (11 a.m.-12 p.m.) |
| Route 359 between Route 31 and Colonial Parkway | June 2000 May 2001 | N/A 2,020 | 254 (5-6 p.m.) 215 (4-5 p.m.) |
| Jamestown Road (Route 31) between Route 359 and Route 681 | April 2001 | 4,350 | 375 (4-5 p.m.) |

Source: Traffic count data collected for the National Park Service by BRW/URS.

3.8.3 Existing Park Visitation

Jamestown Island is a primary tourism attraction in the Williamsburg region. Over the most recent documented six-year period (1995 through 2000), annual visitation has averaged approximately 350,000 visitors per year. Table 3-37 provides a summary of historic park visitation over the same six-year period. July is the highest average month followed by the April through June period, with a second "peak" visitation in October. The park experiences its lowest visitation in January.

During the 2000 peak spring/summer season (April through August), the average daily visitation was approximately 1,497. The highest daily visitation recorded during each of the individual months ranged from 1,975 (August) to 2,998 (April). Peak visitation days occurred on both weekdays and weekends during these seasons.

As noted previously, Jamestown Island is accessed using two primary travel routes: the Colonial Parkway from Williamsburg and other points east of Route 199, and Route 359 from Route 31 to the

Colonial Parkway. Based upon limited turning movement counts (number and type of vehicles and their travel direction—left, right, or straight) conducted in June 2000 at the Route 359/Colonial Parkway intersection, the distribution of park traffic to Jamestown Island is fairly balanced between these two access corridors. Approximately 52% of the total traffic accessing Jamestown Island uses the Colonial Parkway corridor, with the remaining 48% using the Route 31/Route 359 corridor.

3.8.4 Existing Mass Transport

There is a significant mass transport component of existing visitation to Jamestown Island. During peak months of the Jamestown Island tourist season, from 40% to 50% of all visitors arrive at Jamestown Island by charter or school bus. This activity occurs primarily in the spring/summer months of March, April, and May, and in November. During peak days, the bus mode has provided in excess of 65% of total visitors arriving at Jamestown Island. Bus visitors during these peak months are composed primarily of students on school buses and other organized tour groups. Outside the peak season months, the bus share drops significantly, with a low of 1% in August, but otherwise staying in the 10% to 33% range. The annual average bus share over a recent three-year period (1997 through 1999) was 25%.

Bus access is now almost entirely from the Route 31/Route 359 corridor. Based on field observations, some school and charter buses make multiple stops during their trip to the Jamestown area. There is no factual data to identify the extent to how much these bus trips are common to the Jamestown Settlement and Jamestown Island.

Public transit services are provided in the region by James City Transit and in the Colonial Williamsburg area by the Colonial Williamsburg shuttle. However, these transit services do not extend out to the Jamestown area.

Table 3-37: Historical Monthly Visitation to Jamestown

| Month | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | Average | Percent of Year |
|-----------|---------|---------|---------|---------|---------|---------|---------|-----------------|
| January | 5,225 | 2,310 | 6,358 | 6,564 | 6,162 | 6,163 | 5,464 | 1.5% |
| February | 7,861 | 5,965 | 8,004 | 8,105 | 9,086 | 10,875 | 8,316 | 2.4% |
| March | 20,516 | 19,927 | 30,024 | 19,514 | 21,644 | 31,002 | 23,771 | 6.7% |
| April | 40,190 | 41,942 | 40,555 | 36,988 | 38,048 | 57,745 | 42,578 | 12.0% |
| May | 35,214 | 37,506 | 45,373 | 34,931 | 38,064 | 42,729 | 38,970 | 11.0% |
| June | 44,267 | 40,020 | 44,382 | 37,816 | 39,709 | 45,555 | 41,958 | 11.9% |
| July | 59,633 | 47,496 | 46,457 | 43,015 | 42,790 | 46,688 | 47,680 | 13.5% |
| August | 49,265 | 43,493 | 39,092 | 38,078 | 38,796 | 36,349 | 40,846 | 11.6% |
| September | 29,093 | 34,883 | 24,886 | 26,687 | 20,057 | 25,728 | 26,889 | 7.6% |
| October | 37,338 | 44,592 | 34,669 | 35,819 | 34,591 | 37,868 | 37,480 | 10.6% |
| November | 20,131 | 31,826 | 23,482 | 26,177 | 27,868 | 25,475 | 25,827 | 7.3% |
| December | 6,312 | 18,451 | 17,623 | 11,120 | 15,064 | 12,783 | 13,559 | 3.8% |
| TOTALS | 355,045 | 368,411 | 360,905 | 324,814 | 331,880 | 378,960 | 353,503 | 100.0% |

Source: Visitation information obtained from Colonial NHP.

3.8.5 Bicycle and Pedestrian Access

Bicycles are permitted on the Colonial Parkway, although paved roadway shoulders are not provided and formal bicycle lanes are not marked on the pavement. As of the summer of 2001, two bicycle access points have been constructed at Neck-O-Land and Treasure Island Roads. These access points were a response by the NPS and James City County to rogue trails connecting the parkway at these points. NPS staff has noted that pedestrians from adjacent neighborhoods use these access points to walk along the Parkway. There is currently no formal pedestrian access provided to Jamestown Island. Anecdotal information provided by NPS staff indicates that pedestrians infrequently use the Route 359 corridor to walk over to Jamestown Island from the Jamestown Settlement. No factual information was available to document the regularity or frequency of this activity.

A network of regional bicycle trails is developing in the area as well. Route 5, which links Williamsburg

to Richmond and passes near Jamestown, was selected in 1976 to be part of the Bikecentennial Trail, now referred to as the Trans-America Bicycle Trail. In the early 1980's, the same section of the road was designated as part of the Interstate Bicycle Route 76. In 1996, the Virginia General Assembly directed that a study should be conducted to determine the feasibility of locating a hike/bike trail along the Route 5 corridor between Richmond and Williamsburg, and the Capital to Capital Bikeway was created. The bikeway is part of the 2,600-mile East Coast Greenway, a multi-use urban trail system designed to connect major urban centers from Maine to the Florida Keys.

The Trans-America Bicycle Route/Interstate Bicycle Route 76, a more than 3,000 mile long bike route, begins in Yorktown and ends in Astoria, Oregon. The route follows the Colonial Parkway to Jamestown and then travels along Greensprings Road to meet up with Route 5. The Williamsburg Historic Necklace is a

proposed multi-use trail that will initially link 13 historic sites along a 31-mile corridor. Several local and regional plans describe other existing and proposed trail systems. These include: the *James City County 1997 Comprehensive Plan*, the *JCC Park and Recreation Comprehensive Plan*, the *JCC Greenway Master Plan*, the *JCC Comprehensive Sidewalk and Trail Plan*, the *Regional Bikeway Master Plan*, and the *Virginia Outdoors Plan*.

3.8.6 Total Site-generated Traffic Volumes

Approximately 93,500 vehicles are estimated to be attracted to and from Jamestown Island over a one-year period. This is based on using monthly average visitation figures identified previously, recorded monthly average bus versus auto mode shares, and assumed vehicle occupancies of 43 persons per bus and 2.9 persons per auto. This is summarized below in Table 3-38. Approximately 2,000 of these vehicles are estimated to be buses. July is the highest month for both park visitation and total entering vehicles, with approximately

47,680 visitors and about 16,000 entering vehicles. April and May are the highest months for bus visitation, with 454 and 438 buses, respectively.

The previously referenced Colonial NHP *Alternative Transportation System Study* (BRW and Cambridge Systematics, Inc. 2001) for the National Park Service identified an average peak season day of 1,085 visitors, based on the previous five years of visitation data. The park's peak season is identified as April through August, as well as October.

The study also recommended the following guidelines for estimating the "peak" month and "peak" design day:

- The peak design month is equal to 12% of annual visitation.
- The peak design day is equal to 3.3% of the peak design month.

Table 3-38: Estimated Current Vehicular Trips to Jamestown

| Month | Percent by Bus | Percent by Auto | Average Park Visitation | Estimated Number of Buses | Estimated Number of Autos | Total Entering Vehicles |
|-----------|----------------|-----------------|-------------------------|---------------------------|---------------------------|-------------------------|
| January | 11.6% | 88.4% | 5,464 | 15 | 1,666 | 1,681 |
| February | 33.3% | 66.7% | 8,316 | 64 | 1,913 | 1,977 |
| March | 44.8% | 55.2% | 23,771 | 248 | 4,525 | 4,773 |
| April | 45.9% | 54.1% | 42,578 | 454 | 7,943 | 8,397 |
| May | 48.3% | 51.7% | 38,970 | 438 | 6,947 | 7,385 |
| June | 22.5% | 77.5% | 41,958 | 220 | 11,213 | 11,433 |
| July | 2.6% | 97.4% | 47,680 | 29 | 16,014 | 16,043 |
| August | 1.0% | 99.0% | 40,846 | 9 | 13,944 | 13,953 |
| September | 7.8% | 92.2% | 26,889 | 49 | 8,549 | 8,598 |
| October | 21.3% | 78.7% | 37,480 | 186 | 10,171 | 10,357 |
| November | 42.3% | 57.7% | 25,827 | 254 | 5,139 | 5,393 |
| December | 19.2% | 80.8% | 13,559 | 61 | 3,778 | 3,839 |
| TOTALS | 24.9% | 75.1% | 353,503 | 2,047 | 91,545 | 93,592 |

Applying these factors to the 353,503 average annual visitation value results in 1,400 visitors per day in the peak month design day. Average and peak design day visitation during the peak season is thus estimated to generate from 240 to 500 entering vehicle trips per day, depending on the month. The bus mode share varies significantly even during the peak season months. Parking surveys conducted in May 2001 and June 2000 recorded daily (8 a.m. to 5 p.m.) entering vehicles counts of 291 in May (a high bus access month) and 459 in June (a low bus access month).

3.8.7 Traffic Operations on the Colonial Parkway

Existing traffic operations have been evaluated for the Colonial Parkway for peak season and peak hour conditions. Daily and peak hour traffic volumes collected in June 2000 were used. Procedures from the *2000 Highway Capacity Manual* (Transportation Research Board 2000) were used to evaluate the capacity and quality of flow on the Colonial Parkway and at its intersection with Route 359, an intersection that has no signal. The manual uses a qualitative term, Level of Service (LOS), to describe the quality of traffic flow. A range of Levels of Service are provided from A to F, with Level of Service A indicating little to no delay, and Level of Service F indicating extensive delays. The Virginia Department of Transportation has established Level of Service "C" as the lower threshold for acceptable traffic conditions in the Williamsburg area.

Table 3-39 summarizes the peak hour traffic operations at the intersection of the Colonial Parkway with Route 359. The eastbound Route 359 approach to the Colonial Parkway was found to operate at Level of Service B during the evening peak hour (4 to 5 p.m.). All other movements operate at Level of Service A. This indicates that a very good level of traffic service is currently being observed, with little if any congestion being experienced by visitors.

**Table 3-39: Peak Hour Intersection Analysis Summary
Colonial Parkway at Route 359**

| Approach | Approach Volume (vehicles/hour) | Control Delay (seconds/vehicle) | Level of Service |
|-----------------------------|---------------------------------|---------------------------------|------------------|
| Colonial Parkway | | | |
| – Northbound Left Turn | 77 | 7.4 | A |
| – Southbound Left Turn | 0 | 7.3 | A |
| Route 359 | | | |
| – Eastbound Approach | 149 | 12.1 | B |
| Parking Lot Driveway | | | |
| – Westbound Approach | 6 | 9.4 | A |

Note: June 21, 2000 intersection counts used for analysis. Highest peak hour (5 to 6 p.m.) selected.

The Colonial Parkway itself is operating in the vicinity of Jamestown Island with daily traffic volumes of 3,400 vehicles per day or fewer. The estimated daily capacity of a two-lane roadway is 13,000 vehicles per day (Transportation Research Board 2000). The existing two-lane Parkway cross section thus appears to be adequate to accommodate existing peak season traffic volumes with high operating conditions (Levels of Service A or B).

3.8.8 Carrying Capacity of Parking Areas

Public parking facilities are provided at two locations at Jamestown. A total of 61 parking spaces are provided at Glasshouse Point, with 6 of these accommodating buses and recreational vehicles. The main Jamestown Island Visitor Center parking lot has a capacity of 358 spaces, with 25 of these for buses and recreational vehicles. In addition, a small private parking lot is maintained for APVA staff and visitors (accommodating up to 12 vehicles). Table 3-40 summarizes measured parking accumulation data for the two public parking lots.

Vehicles were observed entering and exiting the two parking lots on two occasions (June 2000 and May 2001), and the following information was determined:

- Daily entering and exiting buses,
- Daily entering and exiting autos,
- Daily park visitation (persons),
- Parking accumulation data in 15-minute increments, and
- Mode share of persons arriving at Jamestown Island.

During the May 2001 counts, a high bus mode share was measured (57.7%) at the Jamestown Island parking lot, compared with June 2000 when no buses were recorded. At the Glasshouse parking lot, an even higher bus mode share (74.8%) was recorded in May 2001, compared to 15.2% in June 2000. Some of this may reflect the fact that Jamestown Settlement encourages tour buses to stop off at the Glasshouse Point parking area. Based on a survey of Jamestown Settlement visitors (conducted by the Jamestown-Yorktown Foundation), it was found that approximately 40% of visitors to the Jamestown Settlement also had either already visited Jamestown Island or planned to visit the Island immediately after leaving the Settlement (Hall 2001).

The existing parking supply at the Jamestown Island parking lot is adequate to serve current

demand for both autos and buses for most, if not all, days of the year. The parking area at Glasshouse Point has a regular parking shortage for bus/RV spaces. This shortage (two to three spaces) occurs primarily in the spring months (April through May).

3.8.9 Conclusion

An analysis of the existing transportation system has shown that both the existing roadway network and parking facilities are functioning well at current levels of visitation. The Colonial Parkway, including its intersection with Route 359, has excess capacity and operates at good Levels of Service A and B. Tour buses and school buses are currently the only forms of public transport to the park, and this activity has wide seasonal fluctuations. The distribution of traffic arriving at Jamestown Island is evenly split between the Colonial Parkway and the Route 31/Route 359 corridor; however, bus access to Jamestown Island is almost entirely from the Route 31/Route 359 corridor. The number of buses entering via Route 359 presents some concerns due to pedestrian conflicts with vehicles at the Jamestown Settlement parking lot. The parking supply is more than adequate to meet existing demand overall. There is, however, a shortfall in approximately two to three bus parking spaces during peak visitation days at the Glasshouse Point parking area.

Table 3-40: Existing Parking Accumulation Observations on Jamestown Island

| Location | Date of Count | Total Entering Autos | Total Entering Buses | Peak Auto Accumulation | Peak Bus Accumulation |
|--|---------------|----------------------|----------------------|------------------------|-----------------------|
| Glasshouse Point – 55 auto spaces – 6 bus/RV spaces | June 2000 | 263 | 4 | 46 | 2 |
| | May 2001 | 270 | 21 | 39 | 8 |
| Visitor Center lot – 333 auto spaces – 25 bus/RV spaces | June 2000 | 459 | 0 | 162 | 0 |
| | May 2001 | 270 | 21 | 84 | 10 |

Source: Parking accumulation counts were conducted by BRW and Cambridge Systematics for the National Park Service on June 23, 2000 and May 1, 2001..